Exhibit 22

CONFIDENTIAL

UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF TEXAS

HOUSTON DIVISION

In re ANADARKO PETROLEUM CORPORATION SECURITIES LITIGATION	§	Civil Action No. 4:20-cv-00576
	§	CLASS ACTION
	§	The Honorable Charles R. Eskridge III

CORRECTED EXPERT WITNESS REPORT

Prepared by
LYNDON PITTINGER
Consulting Petroleum Engineer

November 29, 2022

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I. SUMMARY OF ASSIGNMENT

1. I have been engaged by Robbins Geller Rudman & Dowd LLP ("Class Counsel"), counsel for a certified class of Anadarko Petroleum Corporation ("Anadarko" or the "Company") shareholders ("Plaintiffs") during the Class Period of February 20, 2015, through May 2, 2017, inclusive. My report is submitted solely for use in this case.

2. It is my understanding that this is a securities fraud class action alleging Defendants Anadarko Petroleum Corporation, R.A.Walker, Robert G. Gwin, Robert P. Daniels, and Ernest Leyendecker, III ("Defendants") misled the investing public about the commercial viability and producible resource size of Anadarko's deepwater Gulf of Mexico Shenandoah oil prospect ("Shen").

3. Class Counsel retained me as an expert petroleum engineer to examine the technical and economic evidence surrounding Shen to assist the fact finder in understanding the engineering, resource assessment, and economic evaluations at both the technical and managerial levels at issue in the case; and to opine about the adverse information known about Shen's commercial viability and producible resource size leading up to and during the Class Period.

4. I have over 40 years in the energy industry and 30 years of experience working in the oil and gas industry, including experience in oil and gas exploration and production, petroleum engineering, resource assessment, and economic evaluation at both the technical and managerial levels. I am, therefore, qualified to render the opinions set forth below. My professional qualifications are attached as Appendix A.

5. The engineering and geology of a complex appraisal for a field like Shen are closely interwoven. Accordingly, Class Counsel also retained Dr. Robert Merrill, Ph.D., as an expert to examine the geological and geophysical data covering Shen; how Anadarko interpreted that data at the time; and how the geological interpretation impacted resource assessment during the Anadarko appraisal process. Dr. Merrill and I examined much of the factual information contained in the discovery documents. I have reviewed Dr. Merrill's work, and our expert reports contain cross-references. However, the opinions expressed herein concerning the petroleum engineering, resource assessment, and economic evaluation of Shen are entirely my own.

6. Class Counsel provided me with online access to the extensive database of documents produced by Anadarko in the litigation. I operated with the understanding that the documents produced by Anadarko are subject to a stipulated Protective Order. My database search looked for relevant petroleum engineering, geotechnical, risk assessment, and economic evaluation information. The search included an examination of the internal email correspondence between the technical departments of Anadarko and its industry partners regarding the appraisal of Shen and the estimates of its oil and gas resources. I also compared Anadarko's internal technical assessment with the public disclosures made by Anadarko management. Appendix B is a list of documents considered in rendering this report. All engineering conclusions contained in this report are my own. I reserve the right to prepare illustrative exhibits based on the contents of this report if I am called to testify at trial.

7. I have prepared this report to state my opinions, describe the bases and reasons for my opinions, to disclose the facts and data considered in reaching my opinions, and to make other appropriate disclosures. My analyses, opinions, and conclusions are based on my work through the date of this report and informed by my education, knowledge, and over 40 years of experience in the energy industry and over 30 years in the oil and gas industry.

8. No conflicts of interest were created in accepting this engagement. My compensation has been at my normal hourly rate of $450/hour for such services and is entirely independent of the outcome of the litigation.

9. This report is subject to change or modification should additional relevant information become available. I may review, evaluate, and analyze additional data, facts, or information as they become available. I may also seek to respond to opinions or analyses proffered by other experts in this case. I reserve the right to amend or supplement my opinions based upon further information learned, produced, or provided to me; on instruction of counsel; or as a result of any motion or court order that may alter the nature or scope of the claims and issues in the case or at trial. Therefore, the analyses and opinions described herein may be subject to change based upon additional information that becomes available or other developments that occur.

II. SUMMARY OF OPINIONS

10. This report is based on the evidence I have reviewed to date. I understand that additional information may become available, including relevant opinions and analyses by the parties' experts. I reserve the right to modify my opinions based on such additional information.

11. Based on my review and analysis of the information currently available to me, as well as my education and professional experience in the oil and gas industry, it is my opinion that leading up to and during the Class Period:

(a) Shen's producible resource size shrank with each well, falling below the operative resource range[1] post-Shen-2.

(b) Anadarko's operative resource range for Shen did not reflect its structural uncertainties, specifically fault compartmentalization, and variability in reservoir thickness.

(c) After Shen-2, each subsequent well reduced Anadarko's operative resource range for the Shen field, ultimately rendering the field commercially unviable.

(d) Anadarko personnel working on Shen and Anadarko's main partner on the Shen project estimated Shen's producible resource size as significantly smaller and less valuable than Anadarko's operative resource range and the range of expectations post-Shen-2.

[1] "Operative" refers to numbers Anadarko used regarding Shen's resource range and size. Leading up to and during the Class Period, Anadarko used Exploration's numbers from May 2009 until at least Spring 2016.

(e) After Shen-1 and Shen-2, fault compartmentalization was the major risk impacting Shen's commercial viability, a risk that continued through the Class Period.

(f) Results from Shen-3 and Shen-4 caused Anadarko's operative resource volume to decline by 64%, despite both wells being described by Anadarko as successful. After Shen-3, the estimated areal extent of the oil accumulation decreased by 47%, and following Shen-4, the volume was reduced by one-third.

(g) The asphaltene deposition properties of the Shen crude oils had multiple negative impacts on commercial viability, including:

(i) Barriers to flow from fault compartmentalization would greatly complicate efficient pressure maintenance from either water injection wells or an aquifer required to prevent damaging the reservoir;

(ii) Asphaltene onset pressures ("AOPs") rose when crude samples were blended, making commingling infeasible. Commingling, however, was necessary to keep the well count low enough to be feasible; and

(iii) Under the conditions at the time, asphaltene deposition would have occurred in all Shen wells from day one to abandonment, with each well producing enough asphaltene deposits to fill miles of production tubing per year at initial rates.

(h) After Shen-3, Shen's economics were marginal, falling below the corporate discounted profit to investment ratio threshold ("PIR10") and by April 2015, the PIR threshold rendered it more likely than not that Shen was commercially unviable.

(i) Shen 3 could not be used as an injection well or other type of service well and had no future utility.

(j) After Shen-4, and by December 31, 2015, Anadarko senior management understood that Shen was not commercially viable. Although some evaluations showed positive calculated values, no economic evaluations included the full downside risk presented by fault compartmentalization and asphaltene deposition. Incorporating those downside risks, it was known with reasonable certainty that the corporate PIR threshold rendered Shen commercially unviable at that time.

(k) Shen-5 confirmed extensive fault compartmentalization. Even with 1,040 ft. of oil pay, the resource volume shrank significantly after the well. Tar in the LWC proves that reservoir damage from asphaltene deposition had already occurred in the reservoir, the extent of which could not be determined at the time.

12. I elaborate on the above opinions in the rest of the report. As stated above, I reserve the right to modify or supplement these opinions.

III. SUMMARY OF KEY EVENTS AND FINDINGS

13. For ease of reference, I summarize the key events as well as the most salient technical and economic analyses here. The support for these findings is explained below.

(a) After Shen-1 and Shen-2 were drilled, concern over the sub-surface risk of fault compartmentalization was at the fore for Anadarko's and technical professionals. Fault compartmentalization was known to be an important risk to the Shen discovery, which was challenged by having oils with high asphaltene content, requiring reservoir pressures to be maintained above 11,000-13,000 psig to prevent tar damage to the reservoir. The technical teams and management were aware that fault compartmentalization would interfere with the flow connection between the aquifer, injection wells and production wells, allowing pressures to decline more rapidly.

(b) Shen-3 was a dry hole, reduced the resource range for Shen, and had no future utility as an injection well or otherwise. Shen-reduced the resource range for both the Exploration and Pre-Development, despite Exploration's efforts to continue touting an overly optimistic narrative about Shen. Exploration's mean area for each horizon decreased by an average of 47%. With no other changes, the impact would have been to reduce the resource volume by almost half. Instead, Exploration increased the mean net pay by 32% and 16% thicker than Shen-2 net pay. In my expert opinion, Anadarko did not have a valid technical reason to increase the net pay estimate. Their increase required thickening up-dip of Shen-2, exactly counter to the crestal thinning trend observed in seismic lines since 2008. Shen-3 established down-dip thickening but did not establish up-dip thickening. The resulting post-Shen-3 mean resource estimate was revised downward from 1,200 MMBOE to 920 MMBOE. By contrast, Development reduced the mean resource estimate to a much lower 397 MMBOE, 57% less than Exploration's Post Shen-3 estimate and 67% smaller than their pre-Shen-3 volume. MDT pressures indicate that the water legs of Shen-1 and Shen-3 fall along a common regional gradient of 0.50 psi/ft., establishing the downside risk that the shallow oil water contacts ("OWCs") encountered in Shen-1 could extend over part of the eastern fault block, forming the basis for their P90 area. Their P90 net pay assumption was 500 ft., half of Shen-2 but twice that of Shen-1 to account for crestal thinning. In my expert opinion, Development's estimate of 397 MMBOE was more scientifically valid than Exploration's in depicting the resource range and range of uncertainty at the time. Regardless, the resource range significantly moved downwards after Shen-3, whether using Exploration's or Development's numbers.

(c) Darrell Hollek, Anadarko's Senior Vice President of Deepwater Operations in the Gulf of Mexico, testified at his deposition that Anadarko had a corporate economic threshold for development of a PIR10 factor of .30 or greater. After Shen-3, Senior Staff Reservoir Engineer Lea Frye calculated PIR10 measures below .30 for Shen and in several instances, negative amounts. Throughout the remainder of the Class Period, the PIR10 remained below Anadarko's corporate threshold of .3 for the base case without artificial cost reductions.[2]

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[2] *See* Darrell Hollek Deposition dated 9/1/22, page 53, line 6 to page 54, line 4 (Q. . . . you recall that .3 [PIR10] was generally considered the threshold? A. I believe that was sort of a hurdle rate. THE COURT

(d) An April 2015 presentation to Jim Kleckner indicated that the PIR was .08 at $60/bbl without incorporating the downside risks of fault compartmentalization and asphaltene deposition. Anadarko personnel and management knew that Shen was more likely than not commercially unviable by this date.

(e) The results from Shen-4 and its sidetracks confirmed that Shen was uneconomic.

(f) At Shen-4, the original wellbore hit salt and missed the reservoir entirely, reducing the oil in place volume by one-third or 900 MMBOE in the mid-case.

(g) Although Shen-4ST1 was drilled farther south and encountered 626 ft. of oil pay, the economics remained in peril. Most of the Upper Wilcox section was missing except for a lone UW2 sand. The LWC, LWD and LWE sands were of poor quality. The LWD zone was wet, and the LWE sand had 14 ft. of water-bearing sands. Pressures from the sidetrack established that Shen-4ST1 was in a separate fault block from Shen 2 and Shen 1, adding additional evidence of reservoir compartmentalization. Pressures in the ST1 established at least five vertically isolated pressure trends.

(h) The Shen-4 bypass core revealed small scale faulting because its results were so different despite being proximate to Shen-4ST1. The Shen-4 bypass core encountered only 473 ft. of pay, 153 ft. less pay than the sidetrack, despite being located only 300-400 ft. away. The bypass core was missing several sands present in the sidetrack (LWE, LWF, and the partial UW2 sands). Source rock fragments for the LWE zone changed from ST1 to BP1. BP1 was pressure isolated from ST1 just 300-400 ft. away. A minimum of nine faults were identified in the bypass core.

(i) Shen-4 ST2 hit tar and was abandoned. All but one partner had declined to participate in the sidetrack, leaving Anadarko to pay for 90% of the working interest, reflecting a serious decline in partner unity.

(j) After Shen-4ST1, both Exploration and Development revised the resource range significantly downwards. Exploration revised its resource estimate from 920 MMBOE to 755 MMBOE. Despite all the new evidence for fault complexity in the western part of the field, the eastern fault block was still mapped with no faulting or additional uncertainty. Development reduced their resource estimate from 396 MMBOE to 305 MMBOE, 60% lower than Exploration's estimate. At 305 MMBOE, Development's economics showed the project was uneconomic, even with the unsupported assumption of full pressure support from the aquifer. In my expert opinion, given the evidence for complex faulting, full aquifer pressure support was highly unlikely.

(k) Two additional findings further doomed Shen's viability in 2015:

(i) In October 2015, testing of blended oils from Shen 2 showed that commingling production from multiple zones worsened the threat of asphaltene deposition by raising the AOP. Crossflow between zones of different pressures would result in mixing of oils

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REPORTER: A what rate; hurdle rate? THE WITNESS: Yes. Basically an economic threshold to be even considered.").

within the formation, resulting in asphaltene dropout. In my expert opinion, without commingled completions to develop eight different zones, the Shen project was uneconomic due to the number and cost of wells required with single zone or sequential completions.

(ii) It was determined that asphaltene deposition in the wellbore and flowlines could be very costly. Even if reservoir pressures were maintained above the AOP, the produced oil would reach the AOP at some point in the wellbore as it rises, losing pressure and cooling on its way to the surface and would do so from the first day of production to abandonment. Deposition of asphaltenes was inevitable and the primary repair option was coiled tubing cleanout. The December 2015 economic evaluation assumed the cost of these cleanout interventions was $2.4 billion over the life of the project based on an optimistic assumption for frequency of once every five years. The required frequency for these cleanouts and their cost was one of the most important drivers of value.

(l) The economic evaluations in the lead-up to Shen-5 were negative despite being based on overly optimistic assumptions. The economic evaluation presented to Jim Kleckner on December 17, 2015 included the best-case scenarios of no injection needed and no asphaltene damage. Yet, the PIR was negative at -.07 for the base case, rendering Shen commercially unviable.

(m) The economic evaluation Development presented to the Executive Committee on February 1, 2016 for the Shen-5 AFE was over-optimistic, yet still showed Shen was commercially troubled. One reason for the more optimistic numbers is that the presentation was based on the "Joint" volumetric model with a mean resource volume of 426 MMBOE, an approximately 120 MMBOE upwards compromise by Development which was under pressure to increase their numbers. Another was the extreme cost-cutting measures, which were inconsistent from a technical perspective. The well intervention costs for the February 1, 2016 evaluation were reduced from $2.4 billion to $0.8 billion, a 66% cost reduction for the Shen-5 AFE economics. Yet, in the same week, McGrievy's team assumed intervention costs totaling $2.7 billion in an evaluation comparing the economics of wet versus dry trees. In my expert opinion, maintaining a $1.9 billion difference in the most important assumption between two concurrent evaluations is unexplainable from a technical perspective. Finally, although the economics showed a net present value of $208MM, the economics were based on overly optimistic assumptions of full pressure support from the aquifer, requiring no costs for injection wells and facilities to prevent asphaltene dropout from destroying permeability. In my expert opinion, these assumptions were inaccurate and over-optimistic, even while spelling out trouble for Shen's commerciality. Ultimately, the presentation revealed that the PIR ratio was 0.22 risked, rendering Shen commercially unviable.

(n) Despite Development showing over-optimistic economics throughout 2016, the Executive Committee had substantial doubts about Shen's commercial viability and discussed existing the project, based on my review of internal documents.

(o) Although Shen-5 encountered 1,040 ft. of oil pay, the resource estimate declined by 17%, from 426 MMBOE gross to 353 MMBOE. Pressures showed the well was isolated in its own fault block, as were all previous oil-bearing wells, further confirming reservoir compartmentalization. The well was more compartmentalized vertically than any previous well at Shen, with at least 10 separate pressure trends, including three in the LWA zone alone. Oil gravities

were substantially lower (more viscous and lower potential recovery factor) in the Lower Wilcox sands, ranging from 29.3° to 23.7° API. Moreover, 22 ft. of tar was encountered in the LWC sand, potentially rendering the zone unproductive. These findings at Shen-5 were significant because after five wells, no wells had encountered an OWC except for the shallow OWCs in Shen-1 BP2.

(p) Shen-6 provided more bad news. The well was drilled to the east and down-dip of Shen-5 but the well encountered water, proving the well was located in a separate fault block. Shen-6 sidetrack 1 targeted the Shen-5 fault block down-dip of the well, but it too found water, proving that a fault separated the sidetrack from the Shen-5 well. A bypass well encountered tar sands and fluid losses, and the well was suspended.

(q) After Shen-6 and its sidetracks, the Shen resource volume was estimated at 210 MMBOE, assuming an overly 33% recovery factor, full aquifer pressure support and no injection costs.

(r) On May 2, 2017, after close of market, Defendants filed their 1Q2017 10-Q, disclosing that Anadarko had "suspended further appraisal activities" on the Shen project and had taken a $467 MM impairment for the purchase price of the leases and a $435 MM charge for previously capitalized expenses.

IV. INTRODUCTION

14. Exploring for oil and gas in the Wilcox formation of the Walker Ridge area of the Gulf of Mexico (GOM) is a challenging environment. Well depths as deep as 32,500 ft. encounter formation pressures as high as 24,000 psig. Working in water depths of more than one mile and at such high pressures requires among the most expensive drilling rigs in the industry. In early 2014, well costs were estimated at $310 MM to drill and complete. Facilities costs were expected to carry multi-billion dollar price tags. Another challenge at the Shen field was seismic imaging data at depths below a very thick layer of salt, causing difficulties in depth migration. Consequently, appraising a discovery in such a harsh environment required unbiased, quality work from a highly trained and experienced team of professionals empowered to do the right thing.

15. The Shen discovery is located in the Walker Ridge (WR) area of the deep-water Gulf of Mexico. Anadarko operated blocks WR 51 and WR 52 for partners with the following working interest at the time: Anadarko 30% (later 33%); ConocoPhillips ("COP") 30%; Cobalt 20%; Marathon 10%; and Venari 10%. The Shen appraisal program targeted sands in the Upper and Lower Wilcox. The Upper Wilcox Formation is differentiated into three units of increasing depth: Upper Wilcox 1 (UW1); Upper Wilcox 2 (UW2); and Upper Wilcox 3 (UW3). The Lower Wilcox formation is differentiated into five sand units increasing with depth: Lower Wilcox A (LWA); Lower Wilcox B (LWB); Lower Wilcox C (LWC); Lower Wilcox D (LWD); and Lower Wilcox E (LWE).

16. After discovering the Shen field in 2009, Anadarko drilled appraisal wells and evaluated the results with wireline logs and core samples obtained to assess the size and quality of the resource and reduce uncertainties to determine the commercial viability of the resource. The goal of appraising a deep-water discovery is to acquire information about the resource to decide to

proceed with a commercially viable development or exit at a reasonable cost if the resource appears not viable.

17. The six wells drilled on the Shen structure are described above and briefly below as follows:

(a) The Shen field discovery well, Shen-1, was drilled and tested from June 3, 2008 through January 22, 2009, targeting the north-central part of the structure. On February 4, 2009, Anadarko announced the field discovery totaling 300 ft. of oil pay in the bypass wellbore, and only the Lower Wilcox sands were present. The well was sidetracked, and a bypass core wellbore drilled, encountering tar.

(b) Shen-2 was drilled and tested from July 1, 2012 through January 29, 2013 and was located 7,000 ft. southwest of Shen-1. On March 19, 2013, Anadarko announced ~1,000 ft. of oil pay.

(c) Shen-3 was drilled and tested from May 28, 2014 through November 7, 2014 and was located 2.3 miles east and 1,400 ft. down-dip of Shen-2. All sands in the well were wet. Because no hydrocarbons were found, Shen-3 was a dry hole by industry standards.

(d) Shen-4, located west of Shen-2, was drilled and tested from May 6, 2015 through December 21, 2015, with the original hole penetrating the basin margin and no Wilcox sands. A sidetrack to the south was drilled, and Anadarko reported more than 620 ft. of oil pay. A bypass was drilled to obtain the core, and the well was sidetracked again, but encountered tar.

(e) Shen-5, located east of Shen-2, was drilled and tested from March 14, 2016 through August 14, 2016, with Anadarko reporting 1,043 ft. of oil pay. The well encountered 22 ft. of tar in the LWC zone.

(f) Shen 6 and its sidetrack, located east and down-dip of Shen-5, were drilled and tested from December 16, 2016 through April 4, 2017, encountering wet sands in the original hole and the sidetrack that targeted the Shen-5 block. The subsequent bypass well was wet and encountered tar in the UW3 sand. Because no hydrocarbons were found, Shen-6 was a dry hole by industry standards.

18. The locations of these wells are provided in Exhibit 1, and Exhibit 2 shows the two different well naming conventions used in the technical documents.

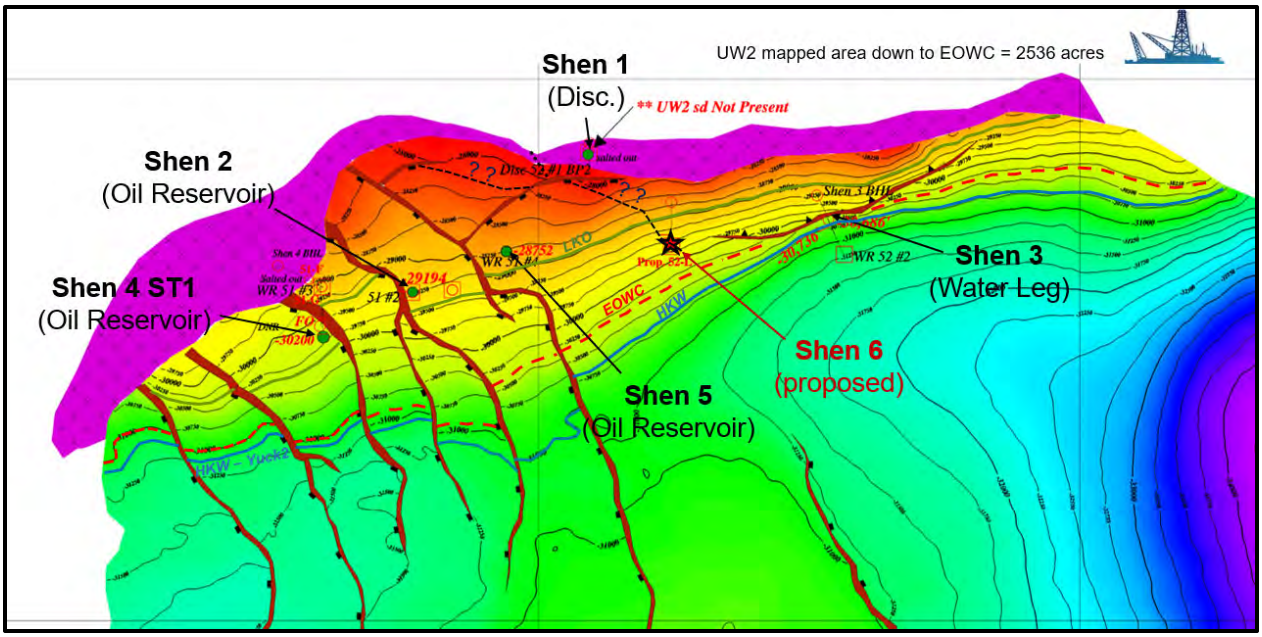

Exhibit 1 Shenandoah Structure Map and Well Locations (9/14/16)

Common Name	Alternate Name	Net Pay ft TVT	Date Spud	Date Finished
Shen-1	WR 52 #1	ND	2008	
Shen-1 ST1		ND		
Shen-1 BP2		236 ft		2009
Shen-2	WR 51 #2	1,002 ft	9/17/2012	3/13/2013
Shen-3	WR 52 #2	Dry Hole	5/29/2014	
Shen-3 BP1		Dry Hole		12/7/2014
Shen-4	WR 51 #3	Dry Hole	5/29/2015	9/8/2015
Shen-4 ST1		626 ft	9/8/2015	10/26/2015
Shen-4 BP1		473 ft	10/26/2015	
Shen-4 ST2		tar		12/21/2015
Shen-5	WR 51 #4	1,043 ft	3/14/2016	8/14/2016
Shen-6	WR 52 #3	Dry Hole	12/16/2016	2/7/2017
Shen-6 ST1		Dry Hole	2/19/2017	3/2/2017
Shen-6 BP1		Dry Hole, tar	3/8/2017	4/4/2017
ND = Not Determined in search				

Exhibit 2 Well Names, Net Pay, and Date (ND = Not Determined)

19. The names of key participants are provided in Exhibit 3, along with their responsibilities during the class period:

PERSONS INVOLVED IN THE CASE AND THEIR RESPONSIBILITIES	
Walker, Al	Chief Executive Officer
Gwin, Bob	Executive Vice President of Finance and CFO
Kleckner, Jim	Executive Vice President, Deepwater and International Development

PERSONS INVOLVED IN THE CASE AND THEIR RESPONSIBILITIES	
Hollek, Darrell	Senior Vice President, Deepwater and International Development
Holly, Brad	Senior Vice President, Operations – Rockies
Daniels, Bob	Executive Vice President, Exploration
Leyendecker, Ernie	Vice President, Gulf of Mexico Exploration
David Blakeley	Manager, Gulf of Mexico Exploration Engineering
Trautman, Tim	Geological and Geophysical Manager, Exploration
Ramsey, Jake	Geologist, Exploration
Johnson, Breck	Geologist, Exploration
Kendall, Beth	Geophysicist, Exploration
Szabo, Shandell	Director of Investor Relations Aug 2015 – Sep 2016
Strickling, Robert	Reservoir Engineer supporting Exploration
Camden, Chris	Reservoir Engineer supporting Exploration
McGrievy, Pat	General Manager, Development (GOM Deepwater?)
Browning, Brad	Reservoir Engineer, Development
Frye, Lea	Reservoir Engineer, Development
Oudin, Chip	Geophysicist, Development
Noll, Christian	Geologist, Development
Chandler, Paul	Geologist, Development
Shotts, Doug	Reservoir Engineer, Technical Support

Exhibit 3 Persons Involved in the Case and Their Responsibilities

V. THE IMPACT OF FAULTING

20. What is faulting and how does it impact commercial viability? Fault planes can be barriers to oil flow, limiting the effective drainage areas of production wells and preventing pressure support between injection wells, aquifers, and production wells. Hence, sealing faults, which act as complete barriers to flow, negatively impact the commercial viability of the field by reducing the recovery efficiency and volume of oil each well can be expected to produce and by increasing the number of production and injection wells required. Paying close attention to compartment boundaries is crucial, otherwise optimal placement of producers and injectors becomes a haphazard and costly exercise.

21. The total cost of injection and production wells was critical at Shen because each well was estimated to cost approximately $310 MM[3] to drill and complete in 2014. Moreover, faulting was a significant risk due to the field's particular environment.

22. The impact of faulting on the commercial viability of the Shen resource was arguably the most critical uncertainty Anadarko was responsible for addressing as the operator. In order to address the risks posed by faulting, Anadarko needed to consider the possibility of fault compartmentalization in their range of possible outcomes. However, instead of remaining open to

[3] APC-01674681 dated 2/19/14.

all possible outcomes, Anadarko Exploration management advocated using a simple unfaulted, laterally continuous structural model, counter to structural models developed by both Anadarko's Shen Pre-Development Team and project partners. This adherence to unrealistic and overly optimistic assumptions by Exploration management and Anadarko's senior management led to public statements exaggerating the likelihood of successful development, resource size, and value.

23. This report will go through each well chronologically, and examine the technical information, resource assessments, and economic evaluations accompanying each. For ease of reference, the first paragraph of each section will feature my conclusions about Shen's resource size and commerciality at each stage. I formed these opinions based on the materials reviewed and my expertise as a petroleum engineer. Geologists and petroleum engineers examine faulting regularly, and it is industry practice for the two specialties to review each other's work. The biggest difference is that geologists examine how faults form, whereas engineers examine how they act as barriers and form compartments. In this section, I primarily focus on fault compartmentalization. To the extent the reader wishes to understand more about how the faults formed, Dr. Merrill's report is useful in that regard.

A. Pre Shen-3

24. Before Shen-3 was drilled, Anadarko gleaned important information from Shen-1 and Shen-2 suggesting that, despite Shen-2's high pay, faulting could impact the field's overall recovery by as much as a third without careful planning. These include (1) that Shen-1 and Shen-2 were isolated from one another; (2) each well was compartmentalized[4] vertically in terms of pressure; (3) oil-water contacts could not be inferred with any degree of confidence; (4) high AOP readings indicated recovery could be reduced by a third just by keeping flowing above a minimum level; and (5) there was a high possibility of either N-S or E-W faulting or both. These findings and discussions around the data will be detailed further below.

25. The Shen-1 discovery well, drilled in 2009, encountered a reported[5] 300 ft. of oil pay, and pressures from MDT surveys indicated pressure compartmentalization vertically in the well. The oil samples from each zone varied in measured density and gas content, supporting a degree of vertical compartmentalization.

26. Formation pressures can be used to infer the depth of OWC when the pressure gradients of the overlying, less-dense oil column and underlying, more-dense water column are known. The intersection of the oil column gradient and water column gradient is defined as the free-water level,[6] a close approximation to the OWC in moderate to high permeability rock. The pressure gradients will correspond to the density of the mobile fluid in the pore space.

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[4] APC-00592977 dated 11/14/13, pages 21, 25.

[5] APC-01669740 dated 4/8/09, page 2.

[6] The free water level is the depth at which the capillary pressure of the oil and water phase are equal. An OWC is defined as the lowest depth at which the oil becomes mobile, which can occur above the free-water level in lower permeability formations.

27. When no OWC is encountered in a well, the pressure gradient of the water column can be based on results from another down-dip well. However, the key issue is that the down-dip water column must be in pressure continuity with the up-dip oil column to establish the OWC. Sealing faults between the water and oil leg would prevent such pressure continuity; lateral continuity of the sands is a critical factor in assessing whether a well provides valuable information about the depth of OWCs.[7]

28. Shen-2, drilled in early 2013, encountered 1,000 ft. of oil pay in what Anadarko identified as eight zones. MDT pressures showed as many as six different pressure trends[8] in the Wilcox sands, signaling a very high degree of pressure compartmentalization vertically. In addition, the MDT pressures proved that Shen-1 and Shen-2 were isolated from each other, most likely by a fault. Each sand was filled to the base with oil, so no pressures in the water leg were available to infer an OWC.

29. Anadarko's Development Team and partners were rightly concerned when they also discovered unusually high AOPs. When AOPs are high, this increases the impact of flow barriers because the operation will require either substantial aquifer support or water injection to prevent premature dropout of asphaltenes in the reservoir and wellbore. Once the pressure falls below the AOP, permeability is badly damaged by introducing solids blocking the pore throats.[9] In other words, the presence of high asphaltene pressures requires more expensive solutions (*e.g.*, aquifers, water injectors) and negatively impacts oil flow and extraction.

30. An email[10] from Dan Bradley with COP to Lea Frye demonstrated the importance that these uniquely AOPs) had on lowering recovery by as much as one-third. The reduction in recovery resulted from raising flowing pressures to prevent asphaltene deposition in the reservoir.

> *"The AOPs were higher than anything we had seen before and we're trying to understand the implications."*
>
> *"Yesterday, I ran a test case in which I switched from THP control to BHP control, to ensure that the FBHPs remain above 15,000 psi. As you would guess, the rates fall off much faster and I lost about a third of the recovery. We've been setting up an in-house water injection study, because we too see the potential for augmenting recovery. Now, however,* ***I'm wondering if water injection needs to become the base case assumption in order to protect us from asphaltene precipitation in the reservoir****. Thus, our understanding of the new data and where it is driving us is*

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[7] Oil water contacts (sometimes referred to as "OWC" in the industry) define the boundary at which oil or water flow. Above the OWC, less-dense oil will flow and below the OWC, denser water will flow. The depth of the OWC is the downdip limit of the oil accumulation. With a structural map of the reservoir interval, the OWC can be used to determine the areal extent of the oil accumulation.

[8] APC-00592977 dated 11/14/13, page 22.

[9] The pore throat is the opening connecting two pores, allowing fluid to flow between the pores. A large pore throat allows fluid to flow freely, resulting in high permeability, and a narrow pore throat impedes fluid flow resulting in low permeability.

[10] Impact discussed in APC-00003707 dated 2/20/14, first mentioned in APC-00578964 on 5/16/13.

really important to us right now as we work through the forecasting and economics to support the well AFE." (Emphasis added.)

31. The potential for north-south faulting impacted the uncertainty in resource size because the Shen structure is highly elongated along an east-west axis. With sealing north-south faulting, each potential fault block would need to be tested, and extrapolations of oil and aquifer gradients located miles apart would be unreliable in determining the depth of OWCs without sound evidence of pressure continuity between wells.

32. The presence of east-west faults would be even more detrimental to the feasibility of Shen commerciality for several reasons. With no faulting, the primary direction of aquifer flow would be up-dip from south to north, and permeability barriers running east to west would block or inhibit aquifer support to up-dip producers. Without aquifer support, injection wells would need to be paired with producers in each of the isolated fault blocks targeted to be developed, increasing the number of critical appraisal and development wells. In addition, the presence of east-west faults would invalidate the inference of OWC depths from down-dip wells.

33. Structural maps of Shen showed faulting as early as mid-2012[11] and into 2013, raising the above-mentioned red flags for the project.

34. A presentation dated March 1, 2013[12] shows a faulted structural map in Exhibit 4 of the Shen field on the LWA horizon, likely authored by Rodriguez, as he is listed as the geophysicist on the title page. This map predates Shen-2 and is an early version of the Development team's interpretation of the extent of faulting based on the available seismic data. Faults are the white linear features on the LWA structure map.

[11] FRYE-002694 dated 8/12/14.

[12] APC-00793752 dated 3/1/13, but the date is uncertain and may be 7/12/12 based on file name and title page "2012-07-12_Foldbelt_Shenandoah_WilcoxA_structure.ppt."

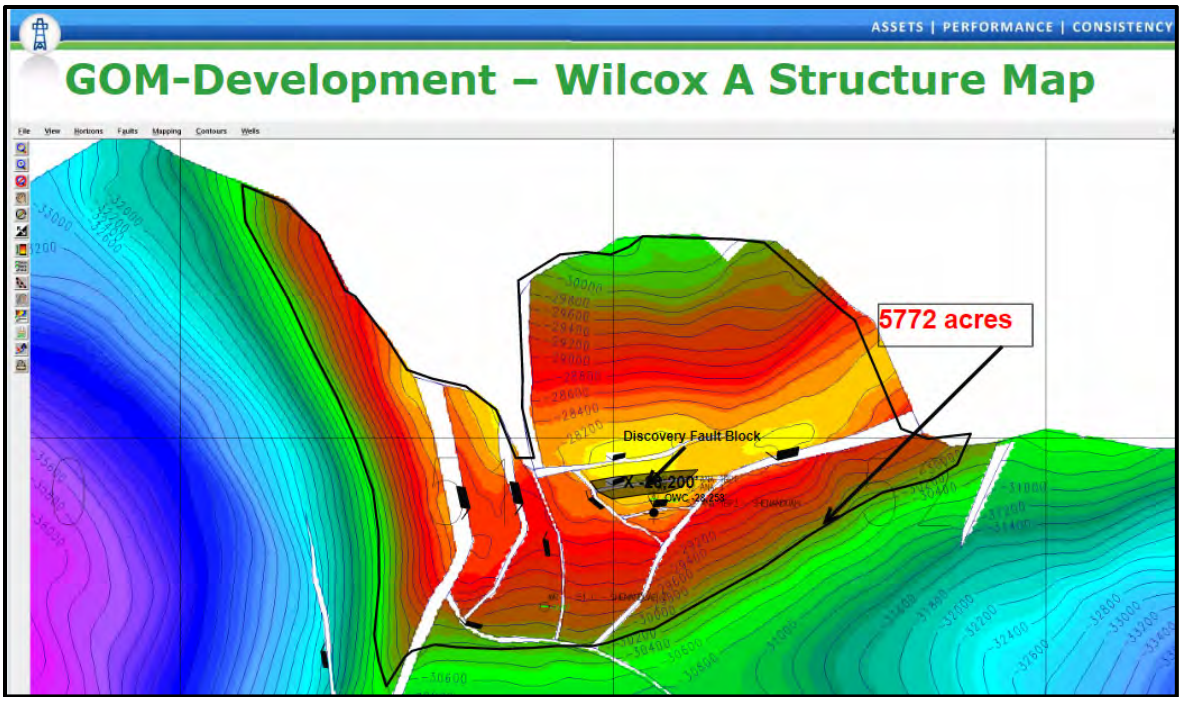

Exhibit 4: Shenandoah Faulted Structure

35. The Shenandoah Work Group was announced[13] on April 2, 2013, with Blakely (Exploration) and McGrievy (Development) as co-leaders. This multi-disciplinary team's mission was to identify "*the challenges, opportunities, and solutions needed to fully appraise Shenandoah and move the project toward sanction as quickly and safely as possible.*" The announcement listed various contributing departments, including Exploration and Development, but did not single out Exploration as having a priority role over other groups.

> *"We would like to assemble a work group to begin preparing for an eventual Shenandoah development. It would consist of stakeholders from Exploration, Development, Drilling/Completions, Facilities, Production, and Land. There are numerous technical and commercial challenges we face in progressing this project that must be addressed. The mission of the team would be to identify and make recommendations on the key decisions that we face in the coming months and develop a work plan for the next 18-24 months that would keep this important project on track for first production within 5 years. We would envision the team identifying the challenges, opportunities, and solutions needed to fully appraise Shenandoah and move the project toward sanction as quickly and safely as possible."*

36. Despite this intention to collaborate, it appears Exploration and Ernie Leyendecker endeavored to stifle Development perspectives on faulting. Evidence for a rift between the Development and Exploration groups regarding faulting appeared as early as October 2013 in an email[14] between Rodriguez and McGrievy. Rodriguez informed McGrievy of a presentation he

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[13] APC-00573912 dated 4/2/13.

[14] APC-00590221 dated 10/17/13.

was to show Exploration regarding his interpretations of faults as follows: "*This is the ppt I plan to show Expl tomorrow am. Slides 1-11 are the updated interpretation. (I added the blue fault in crest – analogue is the Shenandoah discovery FB).*" McGrievy commented that interactions with Ernie Leyendecker may have lacked trust and transparency: "*Thanks for working this Arnold. This is something that we should share with Darrell next week as well. I don't want Ernie blindsiding him or giving him pre-conceived notions before he's heard it from us.*"

37. The unwillingness of Anadarko Exploration management, including Leyendecker, to acknowledge faulting impacted the location choice for Shen-3 and exaggerated the value of information gained from a well in the water leg. In a faulted model, pressures in the water leg would enable projecting OWC's in that particular fault block only, but the OWC's could not be projected across the entire field as claimed later by Exploration. Rodriguez emailed[15] the Development team "*Here's a couple of snapshots of a quick map I made yesterday. Lots of faults set up by the deep Cretaceous structure, which we need to understand a ton more.*" Exhibit 5[16] is Rodriguez's structure map being referenced above, showing several north-south faults along with some east-west orthogonal faults. Faults are the white linear features. Lending credence to Rodriguez's interpretation, Browning responds with "*Some of the partners have interpreted similar fault geometries. If your maps is (sic) correct, Appraisal Well #2 may be testing an isolated fault block.*" Browning's comment that the Appraisal Well #2 (Shen-3) location tests an isolated fault block, which if wet, will not provide a common aquifer pressure gradient from which all OWCs can be projected. This early observation was diametrically opposed to many of Exploration's later claims regarding the value of Shen-3 as an appraisal well in projecting OWCs.

[15] APC-00591016 dated 10/23/13.

[16] APC-00796458 dated 10/23/13, also contains supporting seismic lines to support faults.

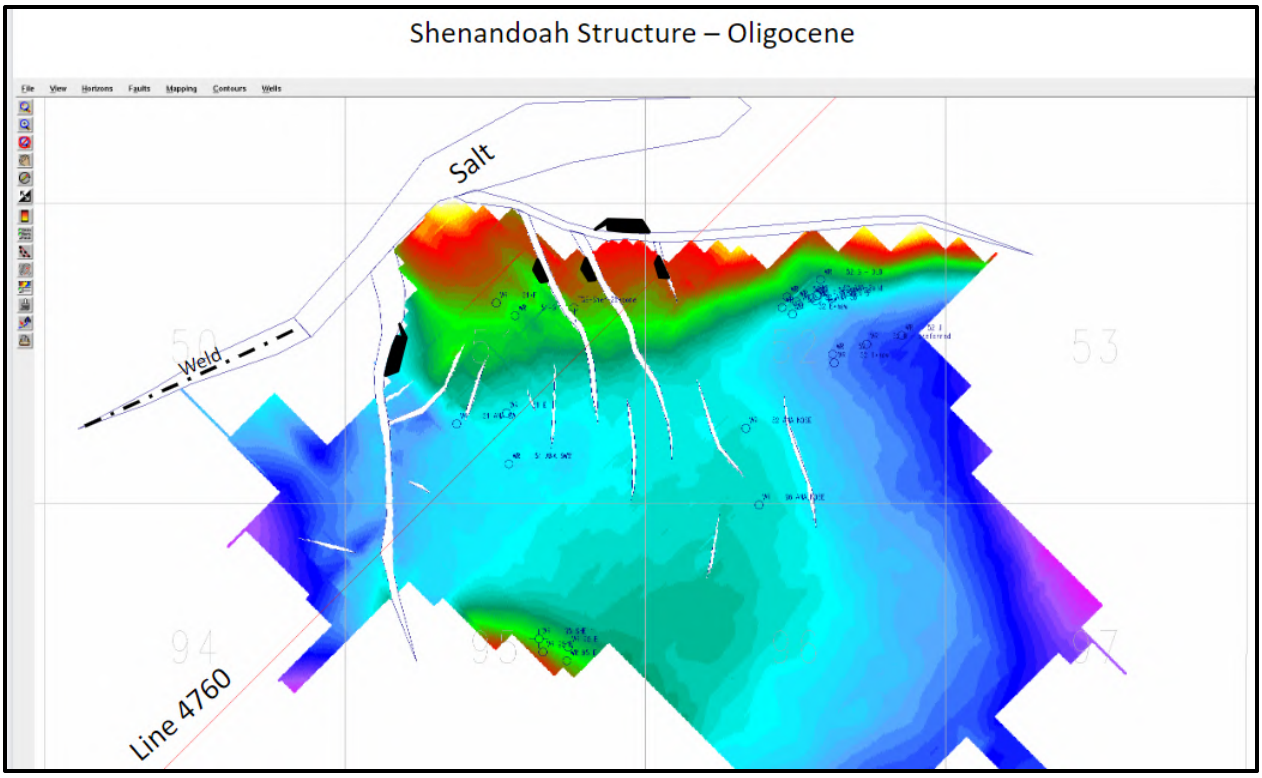

Exhibit 5: Shenandoah Structure - Oligocene

38. Exploration's reluctance to map or acknowledge faults was at odds with their pre-Shen-2 recognition that faulting and compartmentalization were important to the project. For example, the Exploration group recognized the importance of faulting and compartmentalization when preparing the logging program for Shen-2 in early 2013. Ramsey wrote[17] to Trautman in January 2013 the following to justify the oil-based micro-imaging (OBMI) log for the well:

> *"The OBMI dip information will be very valuable toward the project in the following ways:*
>
> *1.) Help tie the seismic and actual well picks*
>
> *2.) Rule out any major faulting or other compartmentalization that may be related to the Oligocene coming in shallower."*

B. The Lead Up to Shen-3

39. Based on my review, strong evidence existed early on that faulting was likely to imperil Shen's economics. The internal data revealed that (1) the pressures from Yucatan 2 indicated that OWC's could not be extrapolated across the field; (2) pressure breaks were indicating compartmentalization; and (3) there was increasing evidence of sealing faults from seismic imaging and the OBMI data. This made Shen more difficult and expensive to appraise, while also portending bad news for recoverable oil and associated economics. In my opinion, the

[17] APC-00003418 dated 1/12/13.

economic analyses incorporating these faulting risks were more accurate and true to the information available at the time. Of particular note are Lea Frye's February 19 and 24, 2014 Presentations, where she found that the PIR was 0.4, and Doug Shotts' August 19, 2014 presentation, where he concluded that the combination of heavy north-south faulting combined with mild east-west faulting could decrease the recovery factor to just 5% and would reduce overall recovery by -81% for a given volume of oil in place compared to the unfaulted base case. His compartmentalized scenario potentially had a net present value of as low as -$2.5 billion, a massive loss for a mega project, and a PIR of -.35 to -.07. In my expert opinion, these findings would be crucial to any prudent operator appraising a challenging and complex deep-water discovery. The evidence will be examined further below.

40. On February 4, 2014, Hollek instructed[18] McGrievy to prepare economics and sensitivities for Kleckner's VP/CEO offsite. This instruction showed the important role of preparing economic evaluations to inform Anadarko senior management of Shen's economic viability and risks. Another important statement in this email by Hollek is that his "*biggest concern would be number of wells needed if we find we don't have a lot of connectivity.*" In my expert opinion, this statement demonstrates Hollek's early awareness of the downside risks of fault compartmentalization.

> *"In speaking to Jim today he wants to see some general economics and sensitivities around a Shenandoah development. He wants me and him to be able to speak to this at a VP/CEO offsite on February 24th and 25th. I know that is not a lot of time. I think Vito with 630 MMBOE and slightly economic has some EC members concerned."*
>
> *"We know this is not AFE quality. My guess is that if we have to drill a lot of wells we better have a lot of reserves.*
>
> *We might be able to use part of the portfolio run, not sure. We need to update with things we starting to better understand. If we build a 2 spar scenario we have good numbers to use.*
>
> *Not sure how to best show sensitivities but he wants us to address risks of such a project. My biggest concern would be number of wells needed if we find we don't have a lot of connectivity."*

41. Lea Frye identified lateral extent and continuity as principal risks in her presentation[19] to senior management dated February 24, 2014, shown in Exhibit 6.[20] Faulting was a major uncertainty affecting both lateral extent and connectivity.

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[18] APC-00598394 dated 2/4/14.

[19] APC-01674832 dated 2/24/14, file name "2014-02_Kleckner_rev2.pptx" to Jim Kleckner, Executive Vice President, Deepwater and International Development.

[20] On February 19, 2014, around the same time period, Frye also gave an important presentation about Shen's economics in relation to faulting. This presentation is covered in paragraphs 190-195.

Exhibit 6: Principal Risks According to Fye's Presentation (2/24/14)

42. Frye was not alone in her assessment that Shen's recoverable resources and economics were potentially imperiled. Brad Browning, one of Anadarko's most senior and well respected reservoir engineers,[21] made several strong assertions about potential low recovery factors, compartmentalization, the viability of pressure maintenance, and the potential for major financial loss in his March 2014 email[22] to McGrievy:

> *"If we limit ourselves to a FBHP of no less than 13K, the abandonment Pbar will be about 14K which gives 7% EUR in this depletion scenario.*
>
> ***Compartmentalization could cut your reserve estimates in half again assuming a fixed well count with each well expected to drain 500 acres.***
>
> *Furthermore, if there's compartmentalization, water pressure maintenance may not be viable, (and the aquifer certainly will not be effective). In this scenario,* ***including the cost for injection facilities and injection wells will only sink the project further into the red.****" (Emphasis added.)*

43. In the same email, Browning provided a sobering comment on whether the critical risks of aquifer support and waterflood feasibility can be addressed before sanction and, if not, whether the project should continue. At an early stage of the project, he questioned whether the Shen project was commercially viable as follows:

> *"Assuming we're committed to pre-drilling wells,* ***if we can't resolve the question of aquifer support or waterflood feasibility before sanction, I question if we should continue with this project.***
>
> *An extended projection test along with interference data might go a long way to de-risking the project." (Emphasis added.)*

44. Browning was one of Anadarko's recognized experts and his professional judgment should be taken very seriously as Camden provided a powerful endorsement from the Exploration group in his deposition quoted as follows:

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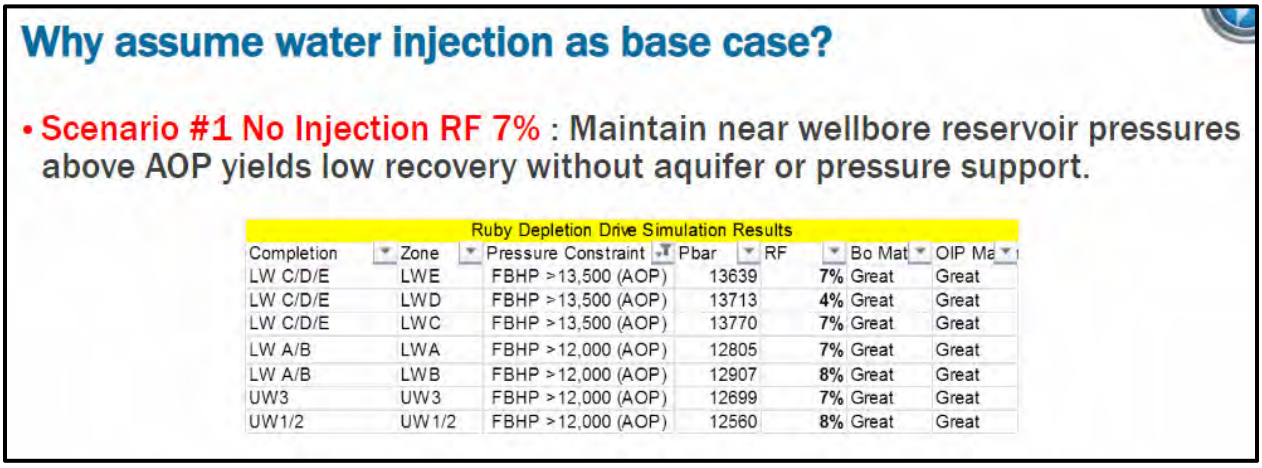
[21] Chris Camden Deposition dated 7/14/22, page 93, lines 1-6; Jim Kleckner Deposition dated 10/14/22, page 59, lines 10-17.

[22] APC-00004620 dated 3/21/14.

"Brad was not on the team. Brad – Brad's not here any longer so I'll speak of him past tense. Brad was one of our, if not our most senior engineer and – and a very valuable reservoir engineering resource. So we typically pulled him in as a – an expert."

45. On March 25, 2014, a presentation[23] prepared by Frye[24] for Kleckner advocated for water injection to be included in the base case, as shown in Exhibit 7. The table shows the simulation results discussed above that without pressure support from an aquifer or injection wells, the recovery factor was calculated to be just 7% of oil in place compared to the 20% assumed in the base case[25] with injection wells included in the development plan. These simulation results were apparently based on a material balance model for a laterally continuous reservoir, so the low 7% recovery factor did not include the negative impact of compartmentalization within the reservoir caused by faulting. The presence of sealing faults within the reservoir would reduce recovery further by blocking flow from isolated fault blocks not penetrated by a production well.



Ruby Depletion Drive Simulation Results

Completion	Zone	Pressure Constraint	Pbar	RF	Bo Mat	OIP Ma
LW C/D/E	LWE	FBHP >13,500 (AOP)	13639	7%	Great	Great
LW C/D/E	LWD	FBHP >13,500 (AOP)	13713	4%	Great	Great
LW C/D/E	LWC	FBHP >13,500 (AOP)	13770	7%	Great	Great
LW A/B	LWA	FBHP >12,000 (AOP)	12805	7%	Great	Great
LW A/B	LWB	FBHP >12,000 (AOP)	12907	8%	Great	Great
UW3	UW3	FBHP >12,000 (AOP)	12699	7%	Great	Great
UW1/2	UW1/2	FBHP >12,000 (AOP)	12560	8%	Great	Great

Exhibit 7: Water Injection in Base Case

46. On March 27, 2014, Rodriguez[26] warned McGrievy and Frye as follows that there were probably more faults than he was able to map given the current seismic imaging quality.

"Subject: Shenandoah Upper Wilcox Structure

Mapping update with the current volume. This is the faulted version and realize that there probably are more faults than I am able to map with the current seismic imaging."

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[23] APC-00822581 dated 3/25/14, with file name "2014-02_Kleckner_rev3_GeologicOverview.pptx," page 36.

[24] APC-00603677 dated 2/18/14 shows Frye forwarding presentation.

[25] APC-00822581 slide 34.

[26] APC-00004757 dated 3/27/14.

47. On April 1, 2014, Browning responded[27] to Rodriguez's recent structural and fault interpretation. Browning makes an important point that faults with small offsets can be sealing, given the potential for deformation banding in 50 mD permeability rock. When fault offset exceeds the gross thickness of the sands, the result will generally be that the fault seals, forming a no-flow barrier with sand on shale contact across the fault. Where fault offset is less than the sand thickness, sand on sand contact may or may not be sealing. Deformation banding is where rock is crushed from pressure and movement along the fault, reducing its permeability and potentially causing the fault to seal, even when sand is juxtaposed against sand. Given the noise in the seismic data, Browning also questioned whether the reservoir is "completely broken up" or is it an artifact of noisy data.

> *"The pink fault is anchored on a deep event with significant offset, but looks to be dying shallow.*
>
> *The red fault looks to have significant offset, but only through one horizon.*
>
> *Really,* ***none of the shallow faults completely offset the Wilcox section. But with deformation banding in 50 md rock, small faults might create drainage compartments****.*
>
> *There's a lot of noise swinging through the data.* ***Is the reservoir completely broken up by faulting or noisy data****?*
>
> *I wonder if we'll know which is the case until a good number of wells are on production.*
>
> *But certainly,* ***if we get more pressure breaks between appraisal wells, we'll have our answer****. Thanks." (Emphasis added.)*

48. Browning then questioned whether the difference between the reservoir was broken up or just noisy data can be determined before the field is fully developed and producing and several billions of dollars are put at substantial risk. Browning makes a very important statement that should have been revisited by Anadarko professionals and management after each appraisal well regarding the significance of "pressure breaks" between wells. Each time a new appraisal well proved to be isolated from its neighbors added a significant negative finding establishing fault compartmentalization.

49. Rodriguez responded in the same email chain with the comment that he thought the reservoir was completely broken up as Browning had theorized.

> *"The interpretation is not completed and some faults have not been fully assessed from the interpretation standpoint. In general, the pink fault on the seismic is approximately 150-220' fault as observed with this 'raw' version of processed seismic.*

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[27] APC-00004880 dated 4/1/14.

> ***I think the reservoir is completely broken as you put it****. I want to have the team with Van to look at the effect of mother salt evacuation from the area of the sediment entry point, to and along the axis of Wilcox deposition.*
>
> *There may be two sets of faults. Large faults were active during deposition (syn-depositional), and the numerous smaller scale faults 50-100' are all post depositional or formed primarily to fill the hole formed by the evacuated deep mother salt." (Emphasis added.)*

50. An email exchange[28] dated April 1, 2014 shows how important fault interpretation was to determining future appraisal well locations. Ramsey with Exploration is included in the exchange with Browning quoted as follows:

> *"If the 'Pink' fault seals, the oil-water contact in the S3 fault block is independent from the S2 fault block.*
>
> *If we receive Yucatan pressure data in the aquifer, we should have an estimated oil-water contact based on gradients from S2, but it will not necessarily be relevant for the S3 fault block.*
>
> *If we find that the estimated contact is above the planned S3 penetration, intentionally drilling a wet S3 test will do nothing to definitely test the large S3 fault block.*
>
> *We cannot assume there is oil above us at S3. (In K2 for example, the north fault block is HC charged in the M14 but the south fault block is wet.)*
>
> *With effectively only one well in our reservoir, I think confirming HC pore volume is still our first priority. Testing aquifer properties might be important, but only after confirming commercial OIP.*
>
> *I believe the sensible approach is to not 'finalize' the S3 bottom-hole location until we have data from Yucatan. And if the projected contact is at a level between S2 and S3, we should move S3's BHL to target above this notional OWC."*

51. The pink fault is depicted in Exhibit 8, which was part of a presentation[29] by Rodriguez subtitled "Complexly Faulted Model." Colored lines depict faults in the seismic cross section, and white linear features depict faults in the colored structure map.

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[28] APC-00004964 dated 4/1/14.

[29] APC-00117313 dated 4/1/14, pages 2 and 4. File attached to APC-00117310 referenced below.

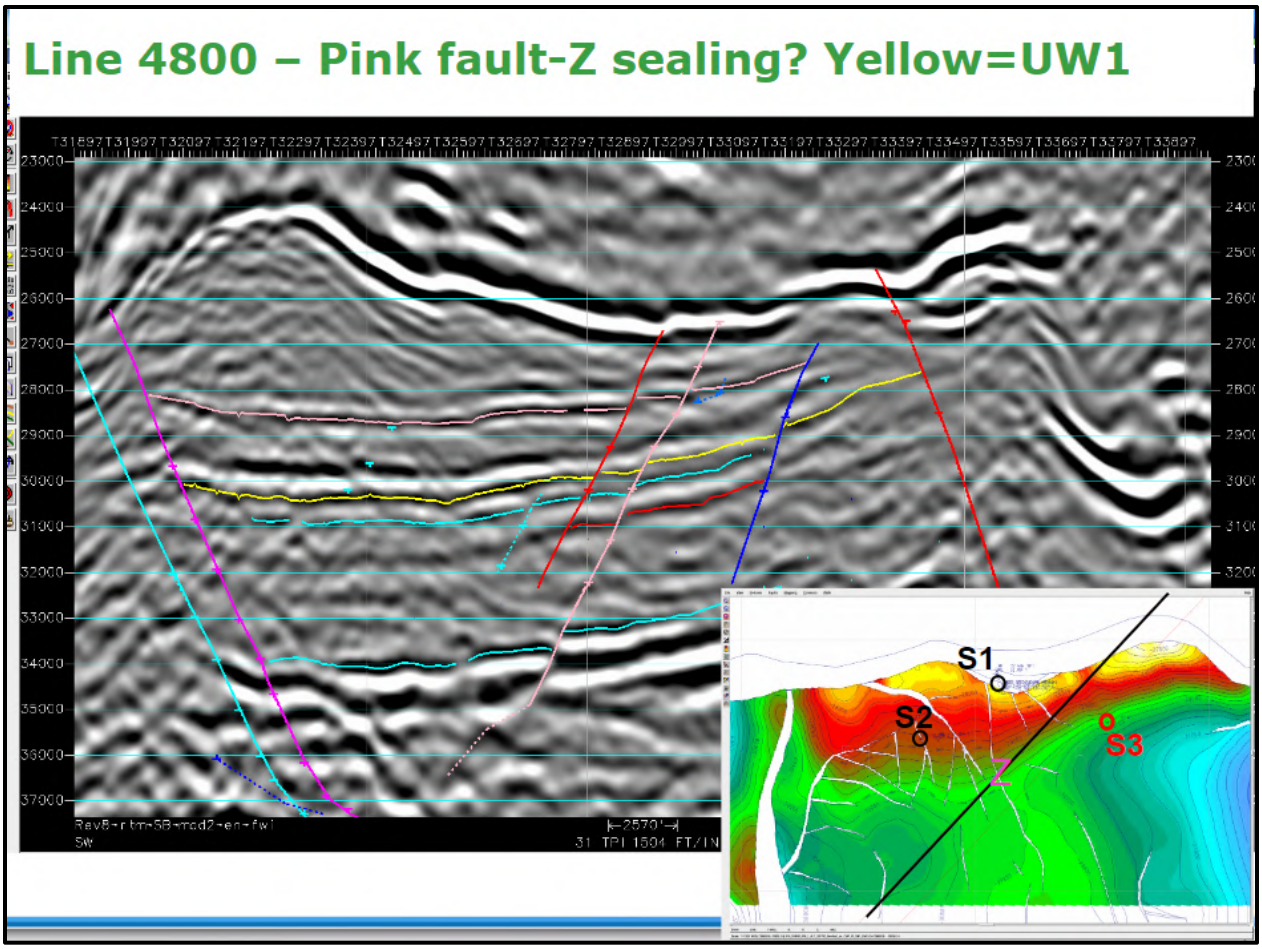

Exhibit 8: Seismic Cross Section With Faults

52. Exhibit 9 from the same presentation shows Rodriguez's interpretation of the fault structure at the top of the UW1 horizon, providing outlines of the S2 and S3 fault blocks. Faults are shown as white linear features. This same structure map[30] of Development's interpretation of faulting was presented to Kleckner on or after April 3, 2014 based on the file name.

[30] APC-01676709 dated 4/3/14, file name "2014-02_Kleckner_final.pptx."

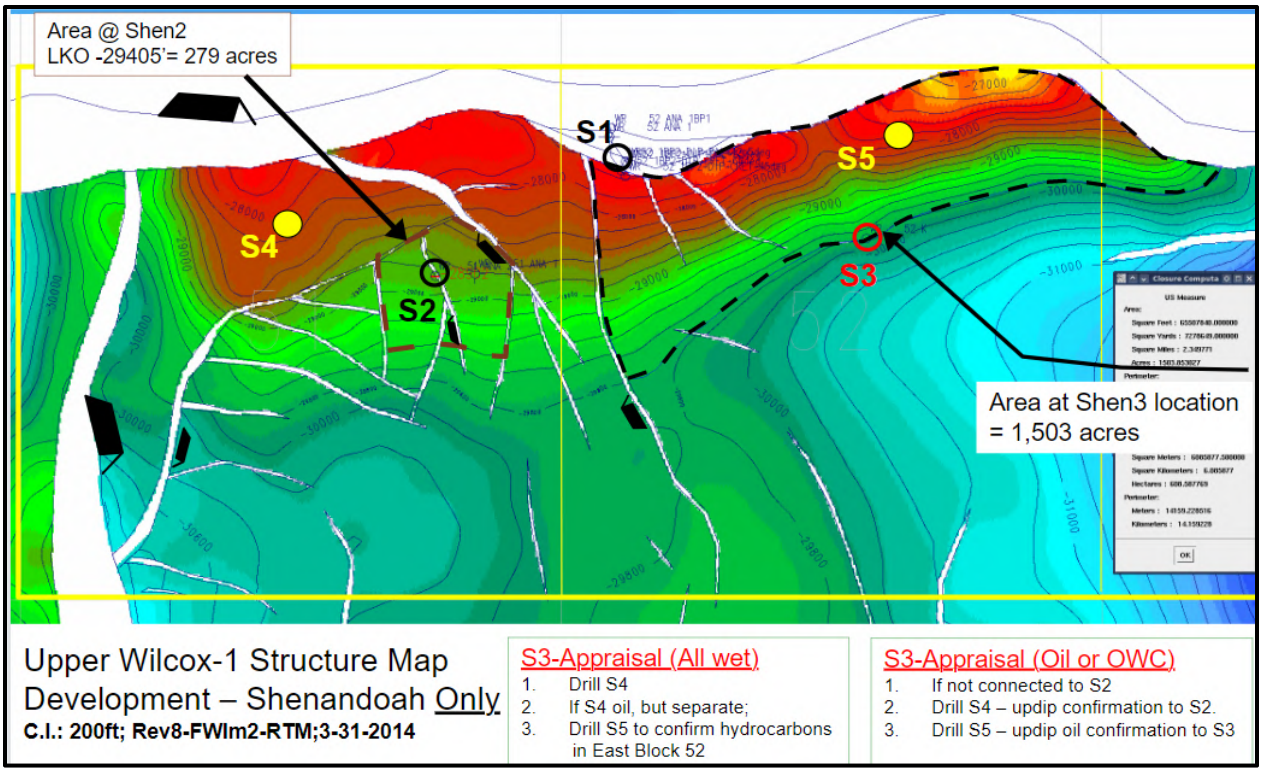

Exhibit 9: Development's Upper Wilcox 1 Structure Map

53. On the same day, Browning responded[31] to Strickling in Exploration, sharing the "Complexly Faulted Model" and mentioning that each fault block may have its own unique OWC and that each fault block will need to be tested with a well:

> *Arnold is picking a number of faults, (as have our partners I believe). I can get you linked access to Arnold's map if you'd like.*
>
> *I'm suggesting that there is a "possibility" that the up-coming Yucatan pressure data will indicate that our planned drill location will be wet.*
>
> *It's just one possible scenario. Other possibilities are that Yucatan aquifer pressures will indicate that Shenandoah is filled to spill; or if Yucatan is full-to-base it may not have any bearing on Shenandoah's contact, (although it might establish a new highest possible water level for Shenandoah).*
>
> *I'm just trying to encourage discussion on how we might use the information to our advantage. If Arnold's structural interpretation has any validity,* ***we can't assume other fault blocks have the same OWC. We have to test each fault block with a well, (starting with the biggest)****. If our projection when we spud S3 is that it will be drilling into the aquifer, I argue that it's not the optimum use of appraisal dollars.*

[31] APC-00117310 dated 4/1/14.

> *I've been told that Shenandoah wells cannot be sidetracked. If that's the case, and we anticipate drilling a wet well, I suggest we 'modify on the fly.' (Emphasis added.)*

54. Ramsey responded to Browning about the lack of consensus around the impact of faulting on the structural interpretation, and that considerable information will be necessary for the various parties to converge on their interpretation:

> *Thanks Brad. I'll check with Jim Kunning on IF the well has any bottom hole flexibility available.*
>
> *An important data point to consider though, is the raw lack of structural consensus (internally and externally) that currently exists at Shenandoah. I have seen eight different maps of Shenandoah from six different companies (two different maps internally), and the only similarity between the 8 is the overall 3-way shape. Attached are the maps from our Shen partners, that were traded several months ago. Unfortunately at the pace I am observing, we will likely not have a consistent map between all respective mappers, until a whole lot more data comes to light (final and consistent seismic to start, pressure data, FLAIR/geochemistry, and possibly even production PTA). Given all the structural uncertainties we currently have with everyone involved, I think it will be a very hard task to persuade a majority of parties (internally and externally) to modify the current bottom hole location of Shen 3, based purely on the Yucatan pressure data. I'll personally be looking at it hard and weighing the options appropriately, but I am mindful of the very complex dance that will ensue.*
>
> ***With all that said though, if any north-south faulting exists that could potentially compartmentalize Shenandoah, it would represent the largest risk element to appropriately appraising this project**. It's my opinion, that we should come to a consensus internally, on the probability of any potential faulting at Shenandoah, and particularly regarding the 'pink' fault**. We're using the same data, we're all on the same APC GOM team, so there should be no real reason we can't reach a consensus. If we are aligned internally, then we will be able to make the appropriate appraisal decisions as operator**. (Emphasis added.)*[32]

55. An example of a differing partner interpretation is COP's interpretation of extensive east-west faulting in the top of the Wilcox structure map,[33] shown in Exhibit 10. Faults are shown as dark curvilinear features.

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[32] APC-00117350 dated 4/1/14.

[33] APC-00117345 contained in file APC-00117344, dated 4/1/14.

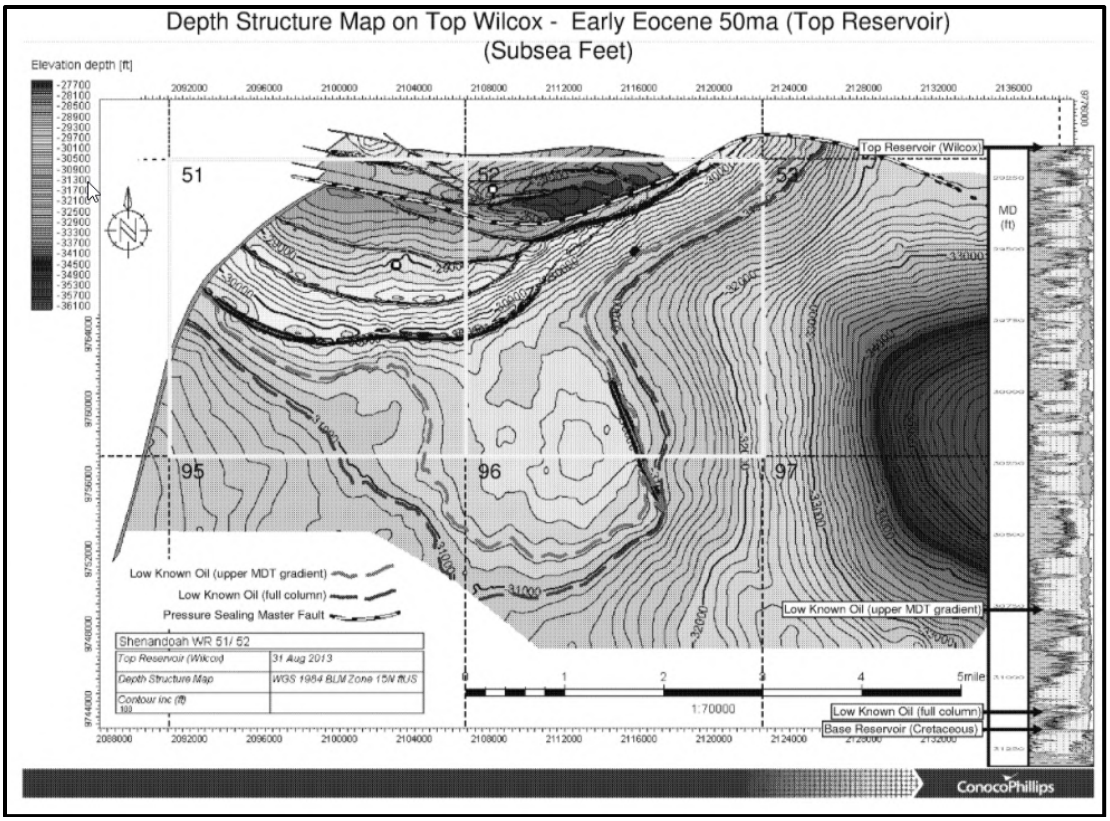

Exhibit 10: COP Structure Map

56. Ramsey made a very important statement regarding the importance of fault compartmentalization in apprising the Shen field, stating that "*if any north-south faulting exists that could potentially compartmentalize Shenandoah, **it would represent the largest risk element to appropriately appraising this project**.*" Ramsey forwarded this exchange[34] to Trautman, his manager in Exploration, which included the following comment: "*Paints a good picture on their value of the north south fault trending down the center of Shenandoah and how it impacts THEIR forward planning*." This statement indicates Exploration conscientiously ignored evidence of faulting, and only the Development team considered it in their well planning logic.

57. The following day, Browning wrote[35] to McGrievy that "it would be a huge mistake to go to project sanctioning assuming that our largest mapped fault block, (S3), has the same oil-water contact as the S2 fault block."

58. Although the Exploration team's numbers were Anadarko's operative figures, the Development team made sure that senior management was aware of their dissenting views and the key risks surrounding Shen. David O'Brien notified McGrievy in an email[36] that his team needed to prepare for Kleckner an evaluation of key risks in the Shen field as follows: "*Jim's asked that*

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34 APC-00117333 dated 4/1/14.

35 APC-00004967 dated 4/2/14.

36 APC-00007119 dated 5/28/14.

we look at all of the key risk issues surrounding Shenandoah & what we are doing to mitigate and the potential impacts to the project's timing, costs & ultimately value."

59. In a subsequent announcement, Chandler wrote in an email chain[37] that the Development team was requested to prepare a study of Shen development risk and uncertainties as follows:

> *Our Shenandoah team has been charged by Jim Kleckner to provide for him a general overview of our risks and uncertainties surrounding the Shenandoah development as we see it today. The idea is that there are many complex issues being addressed by multiple groups and there is a need to better understand all the risks and possible mitigation of those risks as the project moves forward. This is a rather big task but a very important one.*

60. McGrievy added to the announcement that Kleckner had charged the team with identifying Shen risks and uncertainties that will be considered in the Executive Committee's work in the upcoming budget cycle. Shen was considered a mega project in Anadarko's portfolio, requiring a substantial capital requirement:

> *I would like to reiterate the importance of Paul's request from last week for each of you to provide input on the risks and uncertainties for your respective areas of expertise for the Shenandoah project. Understandably, Jim Kleckner wants to recognize where his project execution, financial, environmental and safety risk and exposure lies within each mega project as he will be required to articulate these exposures with the EC during the upcoming budget cycle given the level of capex commitment for this project. This is not unlike risk exercises that have been conducted in the past on these* ***mega projects****. If at all possible, your feedback is greatly appreciated by the end of the day on Friday, June 20th. This will give us time to collect comments and send them out to the team for a final look prior to review with Darrell Hollek and Jim Kleckner toward the end of June. (Emphasis added.)*[38]

61. The final risk registry[39] for Shen placed reservoir continuity in the highest risk score category based on the Development team's input. A meeting[40] was held on July 8, 2014 to review the slide deck in advance of an Executive Committee meeting, establishing that this material was used to inform Anadarko senior management.

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37 APC-00007950 dated 6/18/14.

38 Same.

39 APC-00008478 dated 6/29/14.

40 APC-00609712 dated 7/6/14.

62. Kleckner's email[41] direct to Hollek establishes that the Development team had been tasked to provide their analysis for important Board of Directors meetings:

> *Darrell, at yesterday's EC meeting Al lined out his expectations of having an overview of the business case in GOM prior to the BOD meeting. The latest we could schedule this meeting without running into interference with the earnings call and BOD planning would be July 21-23. I realize this is a short time frame but we need to have the EC briefed on this subject as it will come up at the BOD strategy discussion.*
>
> *If we use Al's memo as a guide and develop a presentation around the questions he has asked we can address many of the issues with the information that you and your team have reviewed on Shenandoah. A key part of the presentation will be the type of exploration, development and commercial opportunity set we can develop in the GOM that will best meet portfolio needs. I realize that Ernie's/Lund's team may require more time to thoroughly characterize this opportunity set but we need to set a date prior to the BOD meeting and work to making this a meaningful discussion. Please let me know your thoughts and I'm happy to discuss.*

63. In Kleckner's October 14, 2022 deposition[42] he testified that Development's work on fault compartmentalization was communicated to and understood by senior management:

> *Q. And so you also shared with other members of the executive committee the risk of reservoir compartmentalization in the Shenandoah field; correct?*
>
> *A. I think that* ***risk of compartmentalization was well understood by everybody****.*

64. Chip Oudin joined the Shenandoah Development team in June 2014 as the team's Geophysicist, taking over Arnold Rodriguez's role. In July of that year, he emailed[43] Beth Kendall, Exploration's Geophysicist, regarding his work on interpreting faults quoted as follows:

> *Arnold has a few N-S faults that I use as guides for my ongoing interpretation (hint: I'm not finished with my final assessment, but* ***I'm confident that some kind of faulting is there****).*
>
> *In the SHEN_DEV_IP project, Arnold has three faults that I would ask you to look at: 001_em_1013_Shen_f6; 002_em_0314_ShnRv8_f6; and 003_em_1013_Shen_R8_m2_f7.*
>
> *In the same project, I have interpreted cfo_ShenRev8m2_WR52_f6 as a single fault that combines elements of Arnold's 001---f6 and 002---f6 faults into a single, N-S trending, down-to-the-SW fault; I'm not convinced at this point whether it should*

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41 APC-00609737 dated 7/8/14.

42 Jim Kleckner Deposition dated 10/14/22, page 73, lines 7-12.

43 APC-00130740 dated 7/16/14.

be one fault or more than one fault. Additionally, while Arnold's 003---f7 fault appears more interpretive than the others, Paul Chandler is convinced that there is a fault cut at the top of the Wilcox in the Shen-2 well, which supports its presence.

I will send you additional snapshots and info for other wells if you want.

65. This email shows Oudin's agreement with Rodriguez and early confidence "*that some kind of faulting is there.*"[44] His interpretation was based on his seismic analysis integrated with work by Chandler using wellbore measurements to identify probable faults.

66. Meanwhile, results from Yucatan-1 and Yucatan-2 MDT pressures[45] shown in Exhibit 11 provided information about the potential for faults to seal and cause compartmentalization. First, Yucatan-1 MDT pressures in the LWA water zone are 180 psi lower than in the overlying oil zone, definitive evidence for an isolating fault intersected by the wellbore. Ramsey concurred[46] that this pressure shift was fault related. Second, the Yucatan-1 water pressures below the fault are 40-60 psi higher than the pressure gradient established by the water-bearing zones in Yucatan-2, again, proving fault compartmentalization laterally between the wells. In my expert opinion, with Yucatan-1 isolated from Yucatan-2 in the water leg, Shen pressures could follow a similar pattern and be isolated from Shen wells. Therefore, establishing Shen OWCs from Yucatan-2 pressures was likely to be unreliable.

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[44] Same.

[45] APC-132687 dated 7/26/14, plot on page 6, cross-section page 3.

[46] APC-00131414 dated 7/21/14.

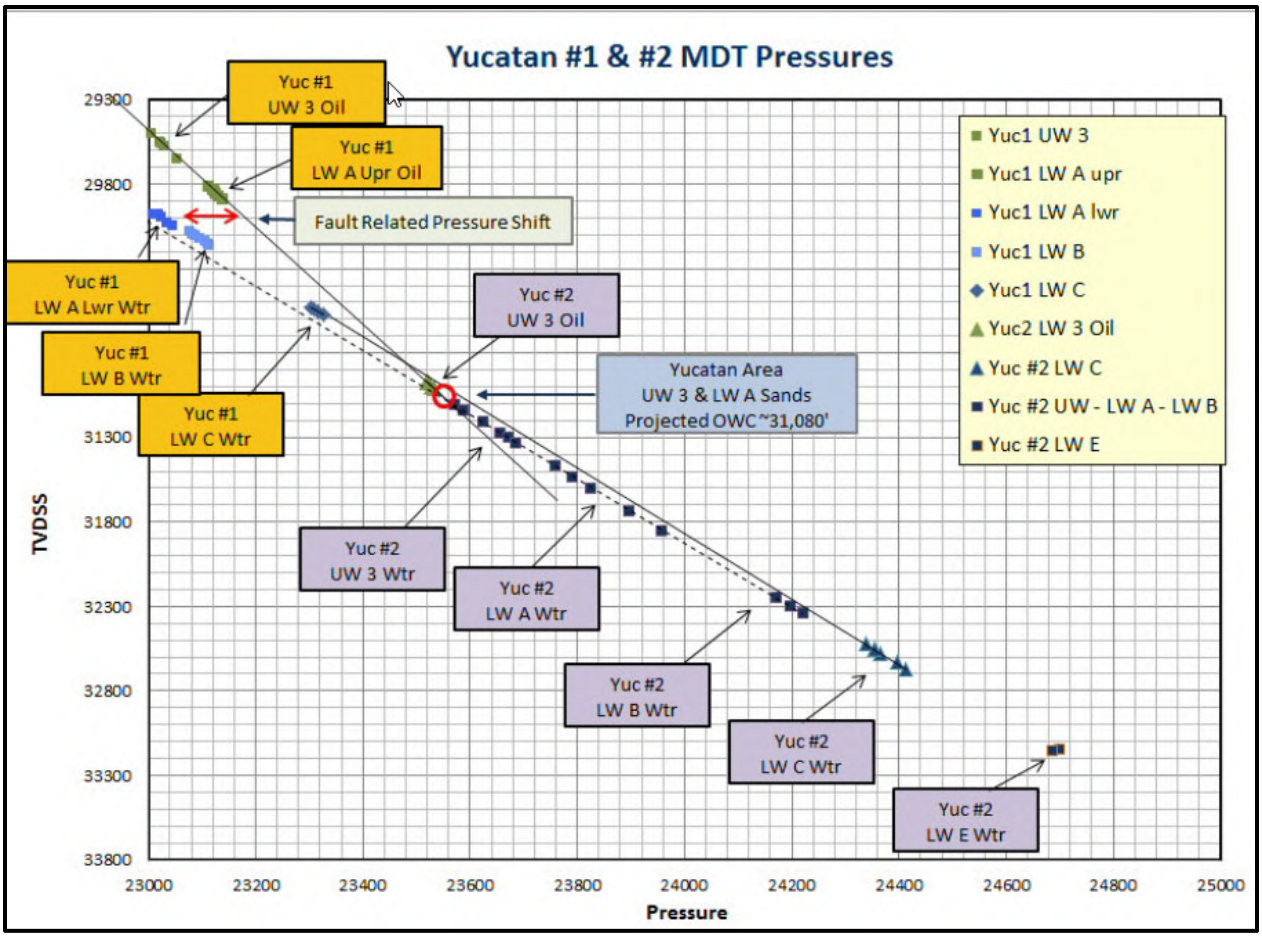

Exhibit 11: Yucatan MDT Pressure Profile

67. A cross-section from the same presentation shows the relative positions of the Yucatan and Shen wells in Exhibit 12.[47]

[47] APC-132687 dated 7/26/14.

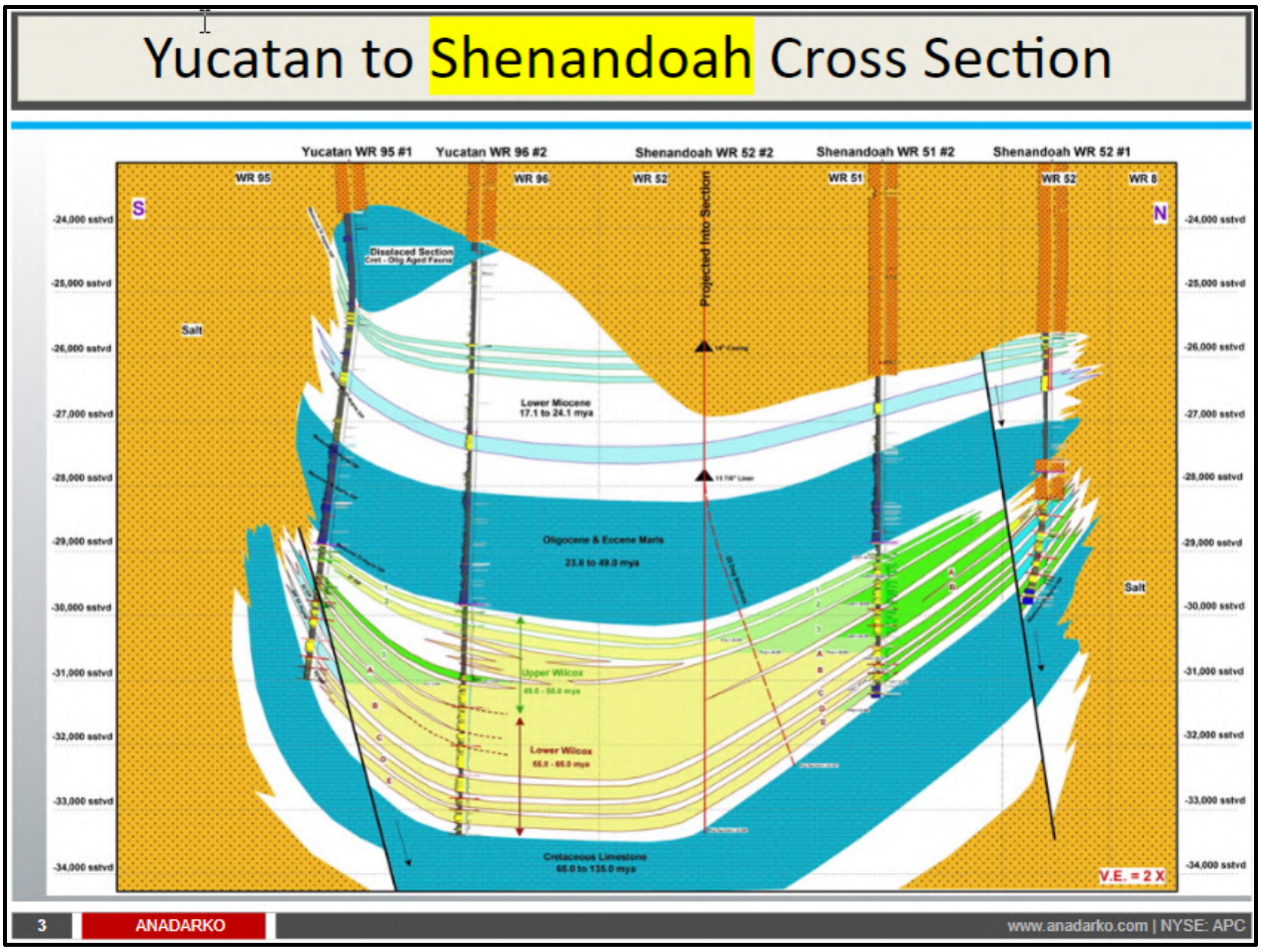

Exhibit 12: Yucatan to Shenandoah Cross Section

68. A partner meeting[48] was held on August 18, 2014 to discuss faults identified by wireline logs, such as dipmeter and Oil-Based Micro Imaging (OBMI) logs. In Shen-1 BP2, four faults were identified with the most obvious fault in the LWC sand, along with 51 fractures. In Shen-2, three faults were identified and "*1 fault found at the top of Wilcox (29,006' MD) corresponds to a seismic interpreted fault*" along with 6 fractures. These findings are important because they establish early recognition of faulting based on wellbore measurements. In my expert opinion, with seven faults identified in the first two wells, Exploration's insistence on an unfaulted structure map directly contradicts this evidence.

69. Despite the importance of faulting to Shen's economics and the uncertainty around their locations, Tim Trautman sent an email[49] stating that Anadarko would present only one version of the Shen structure: *"(2). . . Make sure APC is presenting only one set of structure maps to partners."*

---

48 APC-01677015 dated 8/18/14, pages 9-10 and 14.

49 APC-00000770 dated 8/18/14.

70. In the same email exchange,[50] Chip Oudin, Development Geophysicist, wrote to Pat McGrievy, the manager of the development group, that that he disagreed with the unfaulted tank model:

> *I will need guidance on #2, as I disagree with the unfaulted tank model as currently carried by Exploration post-Yuc-2 (see attached). Depending on what's been shown, to whom it's been shown, and when it was shown, we may be stuck (politically) between a rock and a hard place. Especially if interested third parties are involved in any of the basin discoveries . . . .*

71. One of the attachment's structure maps that he refers to is shown in Exhibit 13 with no faulting over the entire Shen structure.

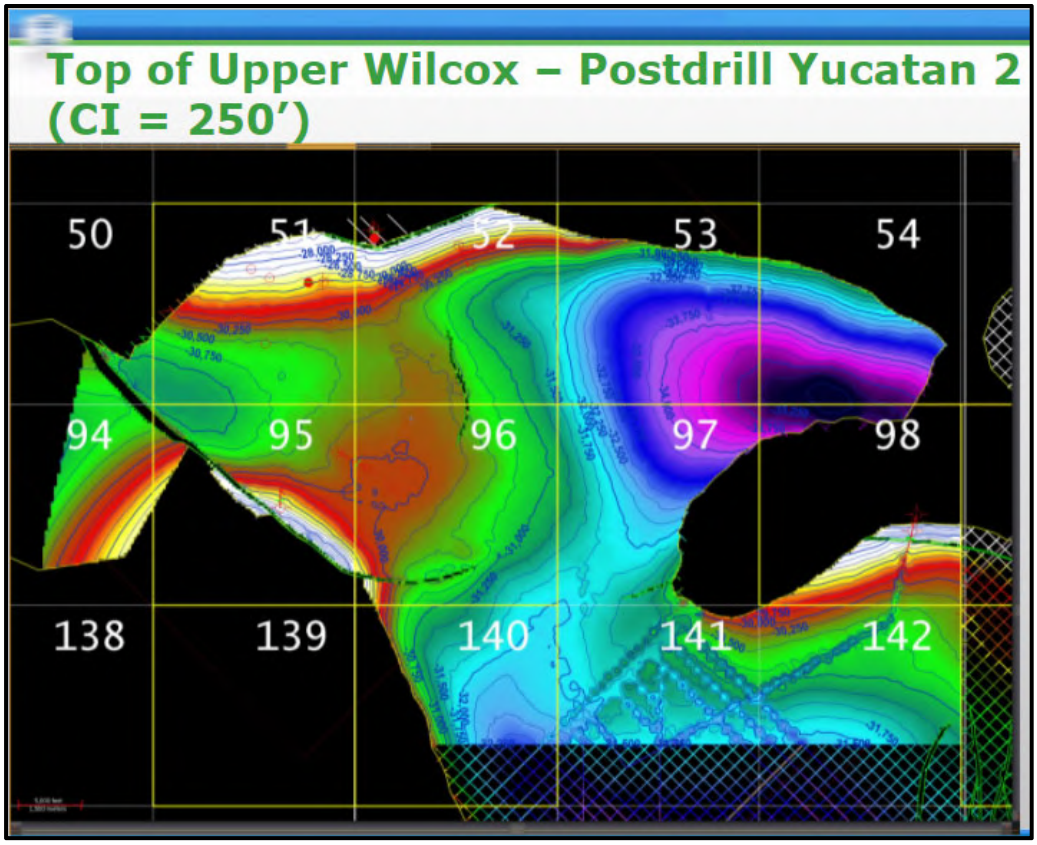

Exhibit 13: APC Structure Map of Shenandoah Basin

72. An email[51] from Pat McGrievy on August 19, 2014 states, that Ernie Leyendecker was adamant about showing only one unified interpretation. In response, McGrievy stated he would have to "*lean on [COP] to get the message out during the meeting.*" Sealing faults can limit the effective drainage area of production wells, which is reflected by running sensitivities on lower recoveries per well:

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[50] APC-00000770 dated 8/18/14.

[51] APC-00000781 8/19/14.

> *I sat down with Tim Trautman this afternoon to talk about presenting alternate interpretations to our partnership and he indicated that* ***Ernie was adamant about showing only one unified APC interpretation*** *but I did get the sense that* ***Tim understood our position*** *and may be willing to negotiate the word-smithing or messaging with our partners as it relates to the modeling work that we are conducting.* ***We may have to lean on COPC to get the message out during the meeting. I think the fact that we are running sensitivities on smaller per well recoveries may suggest to our partners that it could be smaller without actually showing or saying it****. (Emphasis added.)*

73. Other presentations showed how faulting would negatively impact recovery. Doug Shotts presented such results in Exhibit 14 from his reservoir simulation study[52] dated August 19, 2014. The recovery factor in the unfaulted Base Case was 26% of oil in place. With heavy north-south faulting, the recovery factor decreased to 15%. With the addition of mild east-west faulting to mild north-south faulting, the ***recovery factor fell to just 5%***, which would reduce recovery by -81% for a given volume of oil in place compared to the unfaulted Base Case. This finding would be crucial to any prudent operator appraising a challenging and complex deep-water discovery.

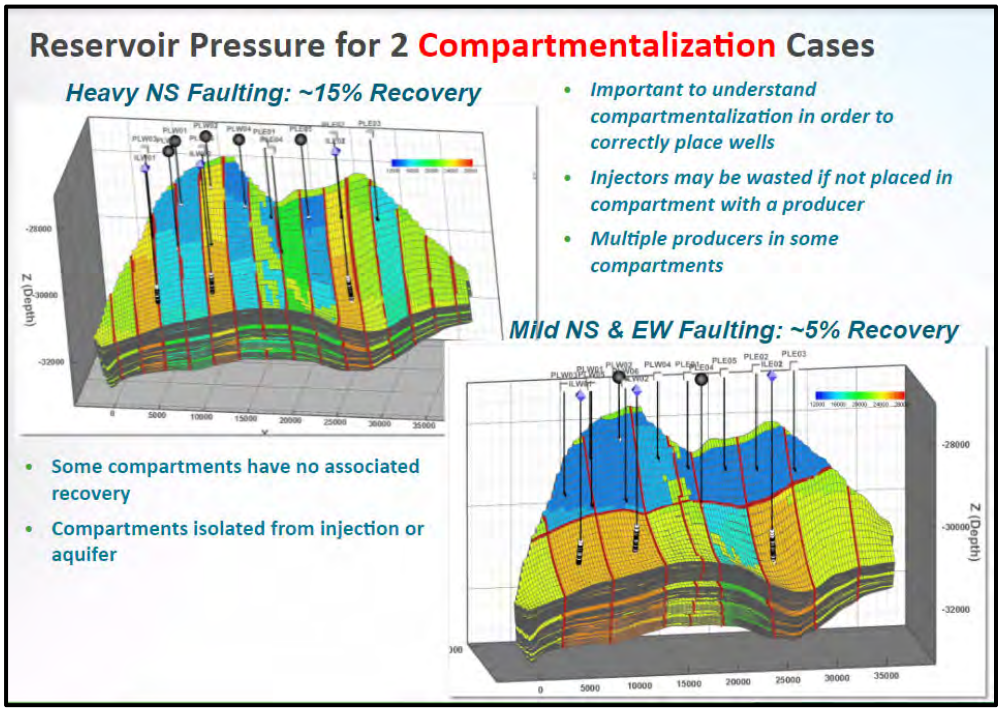

Exhibit 14: Faulting and Compartmentalization (Shotts 8/19/14)

74. Shotts described the practical implications of his quantitative reservoir model of faulting. Compartmentalization causes inefficient oil recovery because some fault blocks may not be effectively drained due to less-than-ideal well placement. At the same time, other producers can be separated by faults from injectors or the aquifer, and barriers reduce the effective drainage area

[52] APC-00137267 dated 8/19/14; Marathon_001579 dated 9/3/14.

of producers, thereby raising the number of wells required to fully develop the field and reducing the oil volume produced from each well. In addition, the asphaltene dropout problem had already identified pressure maintenance as critical to oil recovery. The additional complexity added by flow barriers required pressure support for each producing fault block to prevent premature asphaltene dropout as the reservoir depletes.

75. Shotts' summary states in Exhibit 15 that a highly connected model yields simplistic and overly optimistic recovery estimates. With predominately north-south faulting, effective pressure support can still occur between up-dip producers and down-dip injectors or aquifers. However, each isolated block would require a producer and an injector to achieve the assumed recovery efficiency, raising the potential well count. East-West faults have a more negative impact by limiting the connectivity between up-dip producers, down-dip injectors, and aquifers. Therefore, each isolated fault block would require its pair of production and injection wells. Relatively poor seismic imaging below salt at this depth makes it extremely unlikely that all of the barriers isolating the fault blocks could be identified before development plans are made and production begins. As a result, barriers to flow become much more evident as production depletes reservoir pressure. He provided the following advice for avoiding an economic train wreck: "*An economic train wreck due to uncertainty in subsurface can be avoided through phasing and/or pilots*."[53]

[53] APC-00001974 dated 8/26/14, page 86-87.

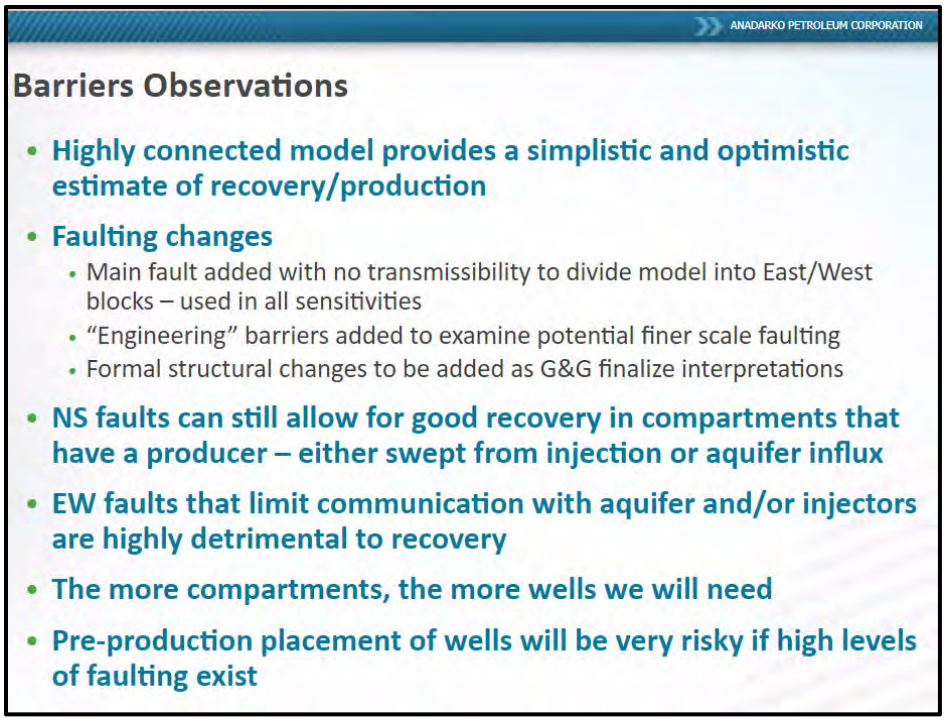

Exhibit 15: Impact of Flow Barriers (Shotts 8/19/14)

76. In Oudin's deposition,[54] he confirmed that he worked with Shotts on a compartmentalized field model as compared to Exploration's laterally-continuous, single-tank model.

Q. Did you help to author any of those presentations that Doug Shotts gave?

A. I don't think I was considered as an author. But did I help contribute with some of the ideas that went into some of the work done? Yes.

Q. And what specifically did you contribute?

A. The possibility of compartmentalization on a structure that at the time was being interpreted as a single-tank model.

77. The Shotts reservoir study findings were important enough to be presented to partners. Hence, it is highly likely that Anadarko management was aware of the importance of compartmentalization no later than August 2014. Despite the importance of these findings, Ernie Leyendecker exercised his management authority and mandated that only a laterally continuous unfaulted model be presented to partners.

78. Oudin prepared a file[55] showing that all partners – Marathon, COPC, Cobalt, Venari, and Anadarko operations – considered the chance of east-west faulting significant enough

[54] Chip Oudin Deposition dated 6/30/22, page 48, line 17 to page 49, line 4.

[55] APC-00011018 dated 8/20/14, with no link to whom it was circulated.

to include in their structural scenarios. However, Anadarko Exploration was alone in its support of a single overly simplistic unfaulted structural model, as shown in Exhibit 16 below:

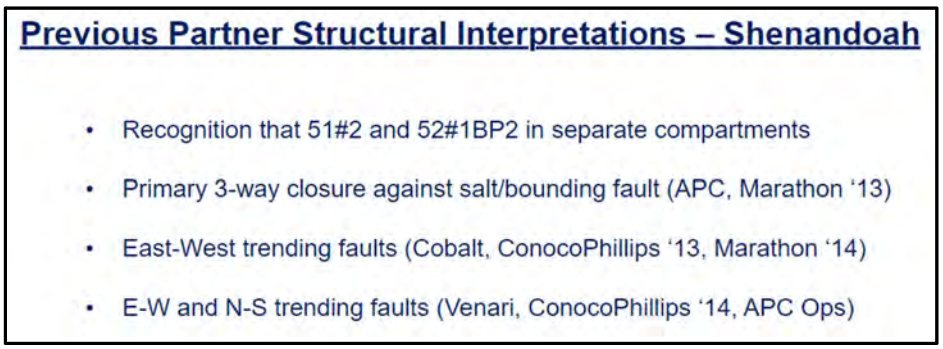

Exhibit 16: Partner Structural Interpretations (Oudin 8/20/14)

79. On the same day, Oudin prepared another file[56] with the following slide in Exhibit 17 showing distinct north-south trending lineaments highlighted with dashed lines mapped on the Upper Wilcox. He includes a note written with sarcasm dismissing the importance of faults: *"Don't worry, these lineaments are not faults and in no way impact the Shenandoah structure."*

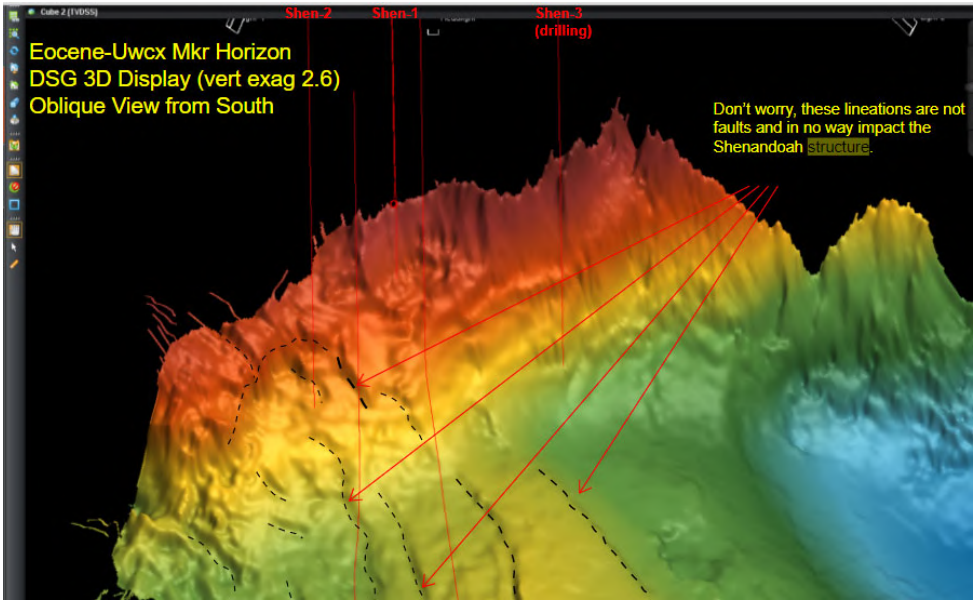

Exhibit 17: Structure Map with Lineaments (Oudin 8/20/14)

80. On August 20, 2014, Oudin prepared a similar presentation[57] titled "Structural Uncertainties Associated with the Shenandoah Discovery" in which he confidently states that, "***[e]vidence for E-W and N-S faulting exists.***" His statement is emboldened with no qualifier as to the presence of faulting. In addition, the magnitude of fault offset appears to increase with depth. The final slide provides the following summary in Exhibit 18.

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56 APC-00011019 dated 8/20/14.

57 APC-00001048 dated 8/20/14, page 23.

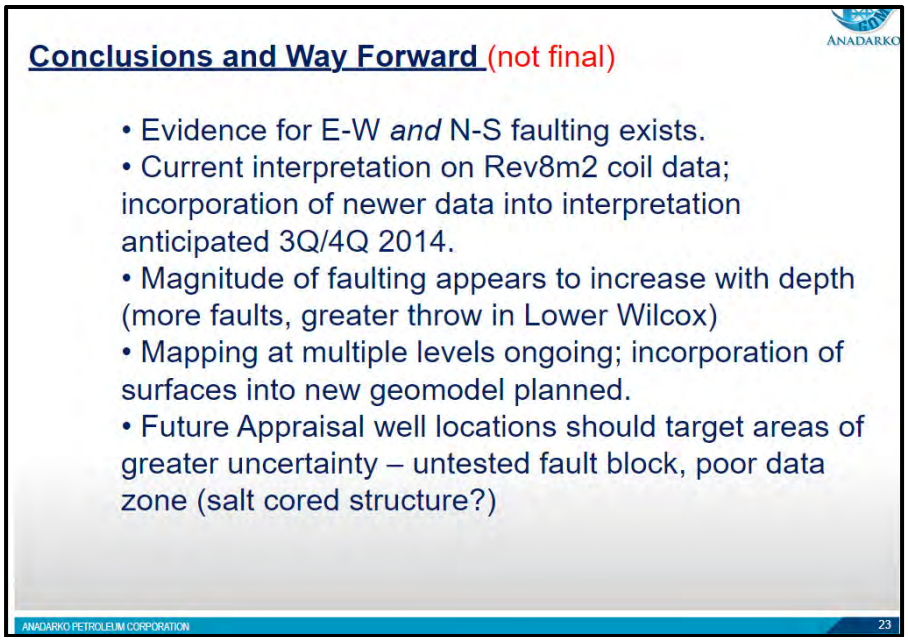

Exhibit 18: Oudin's August 2014 Structural Uncertainties

81. Frye informed Shotts in an email[58] dated August 22, 2014 that his presentation would have to be edited to remove references to faulting to comply with directives from Exploration. In my expert opinion, these editing changes showed Exploration management censoring technical work on the most important risk impacting the Shen project, which was described as a mega project for Anadarko in APC-00007950 dated June 18, 2014, as discussed above:

> *Doug,*
>
> *Based on the dialog/politics between exploration and development we have removed all references to faults and I desensitized the verbiage to remove any word that says "fault" and made the language barriers/compartmentalization.*

82. In reference to the same document quoted above, Shotts testified in his deposition that he was instructed not to use the word "fault" as follows:[59]

> *Q. In the piece that you say "that we aren't allowed to talk about," are you referring to faulting there?*
>
> *A. I think that was referring to not – not using the specific word "fault," correct.*
>
> *Q Or the – the below e-mail is all about faulting; right?*

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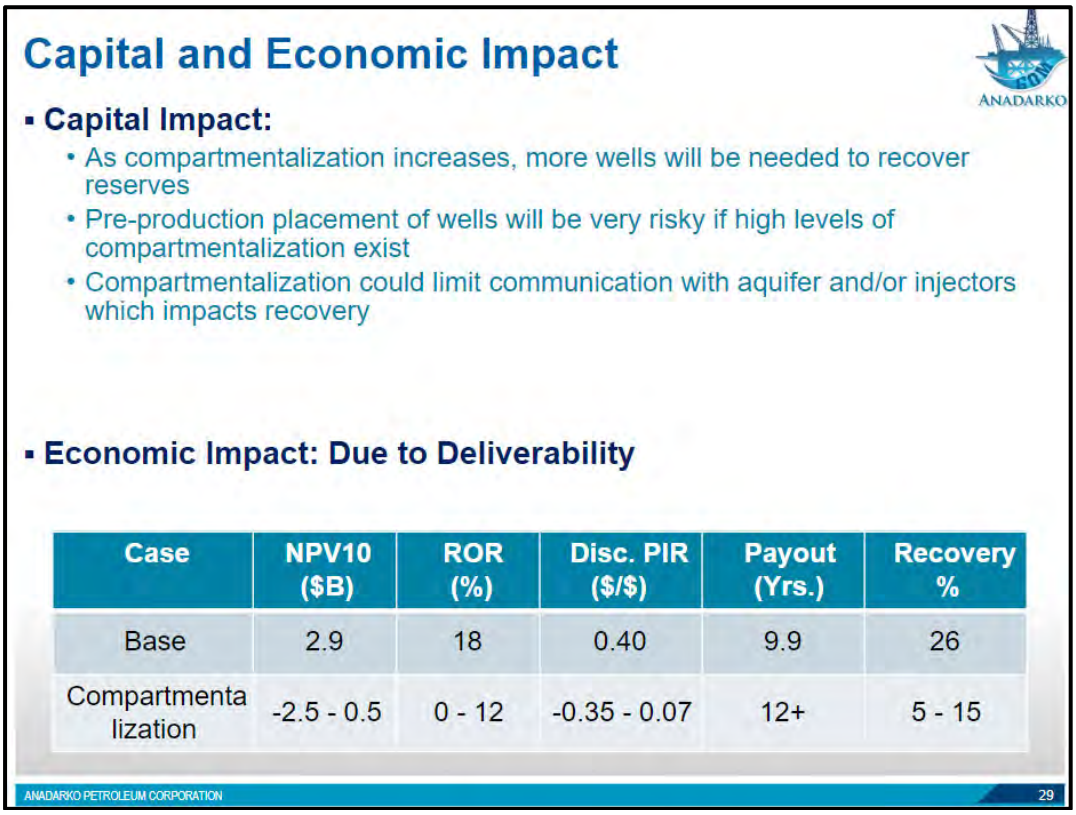
[58] APC-00612283 dated 8/22/14.

[59] Doug Shotts Deposition dated 6/29/22, page 51, lines 18-25.

A. Right.

83. The importance of addressing the issue of faulting was made very clear by Shotts' economic analysis[60] of the compartmentalization case shown in Exhibit 19 below. His compartmentalized scenario potentially had a net present value of as low as -$2.5 billion, a massive loss for a mega project. In my expert opinion, Exploration elected to disregard the risk of compartmentalization and chose instead to censor the use of the word "fault." This information was one of the most important pieces of information on the commercial viability of the Shen project, one of Anadarko's most important projects. This information was seen by management in a budget presentation[61] to the Integrated Project Team ("IPT") on August 28, 2014.



Case	NPV10 ($B)	ROR (%)	Disc. PIR ($/$)	Payout (Yrs.)	Recovery %
Base	2.9	18	0.40	9.9	26
Compartmentalization	-2.5 - 0.5	0 - 12	-0.35 - 0.07	12+	5 - 15

Exhibit 19: Shotts' Compartmentalization Sensitivity

C. Shen-3

84. At Frye's deposition on 10/7/22,[62] she confirmed and described the censorship coming from management as follows: *"The communication from my supervisor to our team, Paul and Chip and myself, that only one set of maps will be shown to keep unity between the teams and*

60 APC-00831111 dated 8/28/14, slide 29.

61 Camden Exhibit 148, dated 8/28/14, page 47.

62 Lea Frye Deposition dated 10/7/22, page 72, line 24 to page 73, line 19.

that the exploration team or counterparts did not want any versions of faulted maps to be shown because it showed uncertainty around the project."

D. Shen-3

85. My primary take-aways from Shen-3 are as follows:

(a) Anadarko's claim that the MDT pressures obtained in the Shen-3 water leg enabled the projection of OWCs across the field was contradicted by internal data and based on the unrealistic assumption of hydraulic communication between Shen-2 and Shen-3 and the rest of the field. In my expert opinion, Shen-3 could not enable the projection of OWCs on the assumption of continuity across 2.3 miles and a fault to Shen-2 with any degree of confidence.

(b) Finding wet sands at Shen-3 reduced Anadarko's resource range, including estimated mean areal extent of the reservoir by 47%. The upside areal extent was even more negatively impacted, decreasing by 57%. A comparison of the June 2013 evaluation versus the post-Shen-3 evaluation in November 2014 is provided in Exhibit 47 and discussed in paragraphs 198-211. In my expert opinion, this decrease in areal extent post-Shen-3 was a significant, negative finding.

(c) In my expert opinion, it is not possible for Anadarko's estimated oil in place as represented by Exploration's evaluations to have expanded as a result of findings from Shen-3.[63] Based on a review of input files, Exploration's assumed recovery efficiency remained the same between their Pre-Shen-3 resource evaluation in June 2013 and their post Shen-3 evaluation in November 2014. Therefore the 23% volumetric reduction in recoverable volume is the direct result of a 23% reduction in oil in place with recovery efficiency remaining constant. Files containing assumptions are provided in Appendix C.

(d) In my expert opinion, Shen-3 supported the model of down-dip thickening, the corollary of which is up-dip thinning. However, under Leyendecker's management, the Exploration team assumed the exact opposite to their advantage in their post-Shen-3 resource evaluation by increasing the assumed total net pay across the field by 32% over their June 2013 study. While Shen-3 helped confirm the model of down-dip thickening, the team assumed the net pay would thicken up-dip of Shen-2 by an average of 17% in the mean case. If the Exploration team had assumed the same net pay model in their June 2013 evaluation consistent with up-dip thinning, the estimated mean resource would have decreased by a comparable amount as the area decrease of 47%.

(e) A discussion of Shen-3's sand quality is incomplete without mentioning that the Shen-3 porosity and permeability were much lower than the previous two wells. Based on Exhibit 50, Shen-3 porosity was 2.3 percentage points lower than Shen-2 and 4.6 points lower than Shen-1. Permeability in Shen-3 was 11 mD, 72% lower than Shen-2 and 97% lower than Shen-1.

[63] Robvert Daniels Deposition dated 10/13/2022, page 95, line 7 to page 96, line 2; Depositition Exhibit 379.

In my expert opinion, Shen-3 sand quality was substantially worse than in the first two wells and should not have been considered excellent quality.

(f) Shen-3 could not be used as a water injector well and had no future utility.

86. In short, the results of Shen-3 rendered Shen unlikely to be commercial. The evidence will be discussed further below.

87. On November 14, 2014, Blakely announced[64] to Leyendecker that in Shen-3, *"All zones were water-bearing*." On the same day, McGrievy writes[65] to Darrell Hollek that the depths of OWCs cannot be determined with confidence from the Shen-3 MDT data. Exploration's projection of OWCs was based on the assumption of hydraulic continuity between Shen-2 and Shen-3, a distance of 2.3 miles, and hydraulic isolation between Shen-1 and Shen-3 based on the correlation[66] attached to the email.

> *"2. We do not necessarily agree that the preponderance of MDT data suggests that we are near OWCs in the U & L Wilcox sands, perhaps only a few hundred feet up-dip, as exploration advertises at this point. Although we cannot refute it as it is a possible outcome, our interpretation of the data may suggests that we are in communication with the Shen 1 which would imply that the OWCs are well up-dip and uncommercial in the FB.*
>
> *3. The bottomline, in our opinion, with the current data set, is that* ***we can neither prove or disprove an OWC contact as the results of the [Shen-3] data*** *are not convincingly definitive in any scenario and we cannot sanction with this potentially ambiguous data set despite the level of optimism from exploration. We still need another well in this FB to prove the column height unless we find some surprising results in the bypass well."*
>
> *I wanted you to have this in the back of your mind when you hear next week that the MDT data suggests a large HC-filled structure just up-dip of the Shen 3. We are not as optimistic at this point until additional data proves otherwise." (Emphasis added.)*

88. As shown in Exhibit 10, COP had already mapped several possible faults that would likely separate Shen-2 and Shen-3, making Anadarko Exploration's structural continuity model inaccurate. In addition, McGrievy expressed his disagreement with Exploration's finding that pressures from Shen-3 suggest a large oil-filled structure just up-dip of the well.

89. On November 17, 2014, McGrievy wrote[67] to his manager Hollek that Exploration continued to adhere to an unfaulted structural model and that agreement on the issue would not

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64 APC-00147463 dated 11/15/14.

65 APC-00147455 dated 11/14/14.

66 APC-00147458 dated 11/14/14, large-format poster.

67 APC-00147547 dated 11/17/14.

occur quickly. McGrievy also laments that it is hard to meet with partners with "a straight face" without acknowledging the key role that faulting has in appraising the discovery, something all the partners and Anadarko development agreed on.

> *"We also have to come to terms with an internal map that both EXP and DEV can support as **they still show no acknowledgment of faulting**; this, however, will not be a deliverable for some time. It's hard to go to partner meetings with a straight face and not acknowledge faulting when all of our partners externally share the same concerns." (Emphasis added.)*

90. McGrievy wrote[68] on November 21, 2014 that results from Shen-3 MDT pressures did not confirm Exploration's interpretation that Shen-2 and Shen-3 are in communication and that Shen-3 identified the depths of OWCs down-dip of Shen-2.

> *"From a development perspective, I think it's important to point out that the **learnings from Shen 3 appear to be inconclusive** with no clear evidence of HC's in the well and pressure data which cannot confirm nor refute any of the three potential outcomes (communication with Shen 2 – large east container, communication with Shen 1 – small east container, or perhaps complete isolation from either penetration of unknown size). Given the current level of uncertainty in sizing the east side, unfortunately we cannot use this data to definitively add needed barrels to our sanction effort. Had we encountered oil contacts at the Shen 3 location, corresponding to communication in the Shen 2 or at least pointing to a larger accumulation, we would've fully supported a more aggressive western F or G location as the next appraisal well site." (Emphasis added.)*

91. Dan Smallwood, COP's GOM Deepwater Asset Development Manager,[69] commented regarding Shen-3:

> *"The wet results of the WR52-2 well failed to narrow uncertainties for COP. Additionally, we carry uncertainly around what was tested within the WR52-1 exploration well in regards to whether we have evaluated the central portion of the Shenandoah structure. Combined these uncertainties yield a current interpretation which remains far from enabling us to proceed with any size/phase development. COP believes there may be well locations which could reduce out interpretations below any minimum field size needed for even a small phase development – and thus a clear walk way outcome."*

92. In response, Hollek asked Smallwood[70] about whether COP's concerns were being adequately addressed by Anadarko:

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[68] APC-00016723 dated 11/21/14.

[69] APC-00147914 dated 11/21/14.

[70] APC-01678356 dated 11/25/14.

"Based on your comments do you feel that partners or Conoco's input is not being considered?"

93. Smallwood's email[71] to Hollek indicated dissatisfaction with COP's inability to influence decisions on appraisal well locations.

"Prior to today, the answer is basically no in regards to this next appraisal well. A while back we were asked if we had any additional EP locations we wanted to suggest, but never had any follow-up to our response nor any indication what locations might be considered by APC. Our Shenandoah Lead contacted Tim Trautman today seeking information on what APC Exploration was considering and we were sent back APC's preferences for a x-y location. That location does not meet our desired objectives."

94. Paul Chandler, a geologist on the Development team, made a statement about targeting the next appraisal well, Shen-4, that demonstrated the impact of faulting on determining the location of future wells. Chandler cited the potential risk of faulting higher in the structure.

Chandler to Ramsey email:[72] "*My tendency anyway would be to avoid being too high on structure as I fear an increase likelihood of more potentially faulted section so again I think a straight hole here might be just fine. I also agree with you that as soon as you guys and our development team gets a finalized structure map completed on our key Wilcox horizons we should compare to make sure a straight hole at this F location is OK."*

95. Oudin expressed concern that north-south faults had been mapped by Exploration at least twice already, indicating that faulting would potentially isolate Shen-2 but remain excluded from their current structural map. Yet these north-south faults are considered very seriously by the Development Team and partners.

Oudin to Chandler email[73] (11/25/14), cc to Frye and McGrievy: *"You know, I just got into the Exploration Seisworks project across Shenandoah, and the main fault that potentially separates Shen-2 from the rest of the world (trending NW-SE, down-to-the-southwest, possibly intersecting Shen-2 at the bottom of the well) has already been mapped, at least twice. Someone needs to explain to me why it's never shown up on any Expl maps. We should have a good time next week going over what is and what isn't significant . . . ."*

96. In a sarcastic response, Oudin expressed doubt that these faults were recently mapped. This indicates that Exploration's knowledge of the possible existence of these faults might date back further into the time period where Exploration advocated strongly for an unfaulted structure map.

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71 APC-00617403 dated 11/25/14.

72 APC-00016757 dated 11/25/14.

73 APC-00852630 dated 11/25/14.

> Oudin to Chandler Email[74]: *"Both versions were probably mapped in the past week, right??? Although if I really wanted to be a pain in the a--, I could find a date-stamp for those faults and determine when they were created."*
>
> Chandler responded: *"The smoking gun??"*

97. Leyendecker expressed an unwillingness to change the targeted location of Shen-4 and asserted that other maps would not be considered in targeting the well because they were based on fundamentally flawed geologic and geophysical principles.[75] No specific details were provided to support his claim. In my experience, given the amount of time Leyendecker spent with the maps, a mere day, relative to the skilled and interdisciplinary team's months, this claim was baseless.

98. Notes from a joint meeting[76] between the Exploration and Development teams on December 1, 2014 and December 2, 2014 indicate that the technical teams agreed that a north-south fault divided the field into an east and west component. Compartmentalization from faulting was listed as a key uncertainty in selecting appraisal well locations. Finally, both teams agreed that the P90 resource estimate was too high because faulting could affect the lateral extent of the oil accumulation, especially to the east. This meeting is significant because it resulted in some areas of agreement between the Exploration and Development technical teams despite Leyendecker's vehement opposition to a faulted model.

99. An important email chain[77] shows Exploration proceeding based on the unfaulted model despite agreeing to the existence of a north south fault at the December workshop described above. Hollek wrote to McGrievy on December 1, 2014 expressing disappointment that Exploration announced a recommended location for Shen-4 based on an unfaulted model as follows:

> Hollek to McGrievy email dated 12/1/14: *"I am disappointed we did not work through the joint meetings first."*

100. In the same email chain, McGrievy responds by saying that he thought Trautman had agreed to work through differences for an interpretation both Exploration and Development could support. He did not understand why a recommended location was publicized to partners when it was still internally debated.

> McGrievy emailed Hollek on 12/1/14: *"I talked with Tim Trautman immediately after leaving your office this morning and I thought I had an agreement with Tim that the technical teams would work through the differences in interpretation and develop one or two outcomes that both teams could support. Furthermore, it was my understanding that the results would be shared assuming that we came to a*

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[74] Same.

[75] APC-00148076 dated 11/26/14.

[76] APC-00617572 Word document dated 12/2/14, "Shenandoah Exploration Development Team Workshop.docx."

[77] APC-00617562 dated 12/2/14.

> *single collective interpretation. Chip, Paul and Paul Schlirf did meet today with exploration (Jake and Beth) to begin the mapping reconciliation process and have plans to continue tomorrow working together. I don't understand why we publicized the recommended location in the e-mail already when I thought that it was still debatable, internally. Obviously, This will not sit well with COPC and probably Cobalt. I was not copied on the meeting proposal to the Shenandoah partnership Land contingent but only forwarded as an FYI."*

101. The final email in the chain from McGrievy to Hollek on December 2, 2014 states that McGrievy's preference would be not to attend the partner meeting, objecting to showing only a case with "*little or no separation via faulting.*" McGrievy states that "*it will be difficult for me and quite frankly* ***ethically questionable to openly support their current maps*** *which show no discontinuities.*" To McGrievy, he appears to raise his concerns about showing an unfaulted structure not as a technical issue but as an ethical issue.

> McGrievy email to Hollek dated 12/2/14: *"Darrell, not to beat a dead horse here, but after thinking about it (provided that you don't oppose the idea), my preference would be not to attend the partnership meeting next Wednesday with the exploration team if they appear defiant in working with us to develop a map that indicates acknowledgment of faulting that would suggest potential separation from their currently proposed F location. Unless they (exploration) can convince us over the next couple of days that there's* ***little or no separation via faulting****, it will be difficult for me and quite frankly* ***ethically questionable to openly support their current maps*** *which show no discontinuities. I was never sent an official invitation which may imply that they prefer I not be there in the first place." (Emphasis added.)*

102. An email[78] quoted below from Kleckner to McGrievy showed senior management's awareness of Development's identification of faults and its impact on appraisal strategy – where and in what order to drill the wells.

> *"In looking further at the maps I can see where this argument can be turned to support the B location first if the E-W trending fault that separates B from S2 is not present. Our map shows a substantial fault separating the two locations, does exploration have the same fault mapped? If not I can see their argument for going up dip and proving up this area if it is continuous."*

103. A partner meeting was held on December 10, 2014, addressing the Shenandoah appraisal strategy. Anadarko presented a structure map[79] with only one fault between Shen-2 and Shen-3, as shown in Exhibit 20. This map by exploration was an early display of their recognition of a north-south trending fault located near Shen-3.

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[78] APC-00148411 dated 12/4/14.

[79] APC-00857379 dated 12/10/14 with map at page 26, APC-00857404.

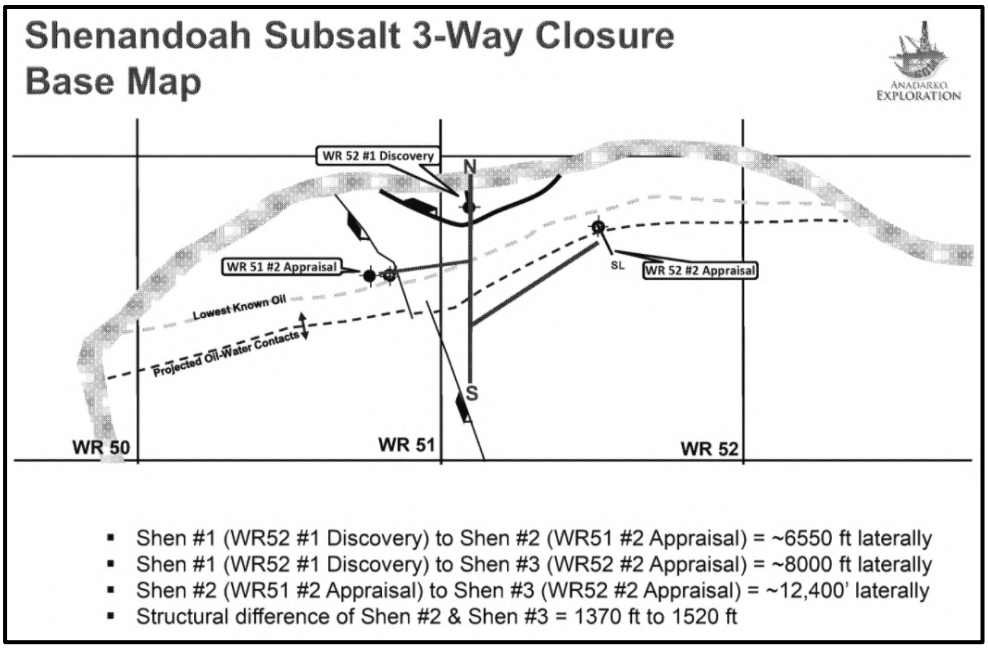

Exhibit 20: North-South Fault Mapped (APC 12/10/14)

104. In contrast, COP presented a much more faulted structural picture in Exhibit 21,[80] below. Instead, COP's structural interpretation included four N-S trending faults shown below, with two faults potentially separating Shen-2 and Shen-3.

[80] APC-00151169 dated 12/16/14.

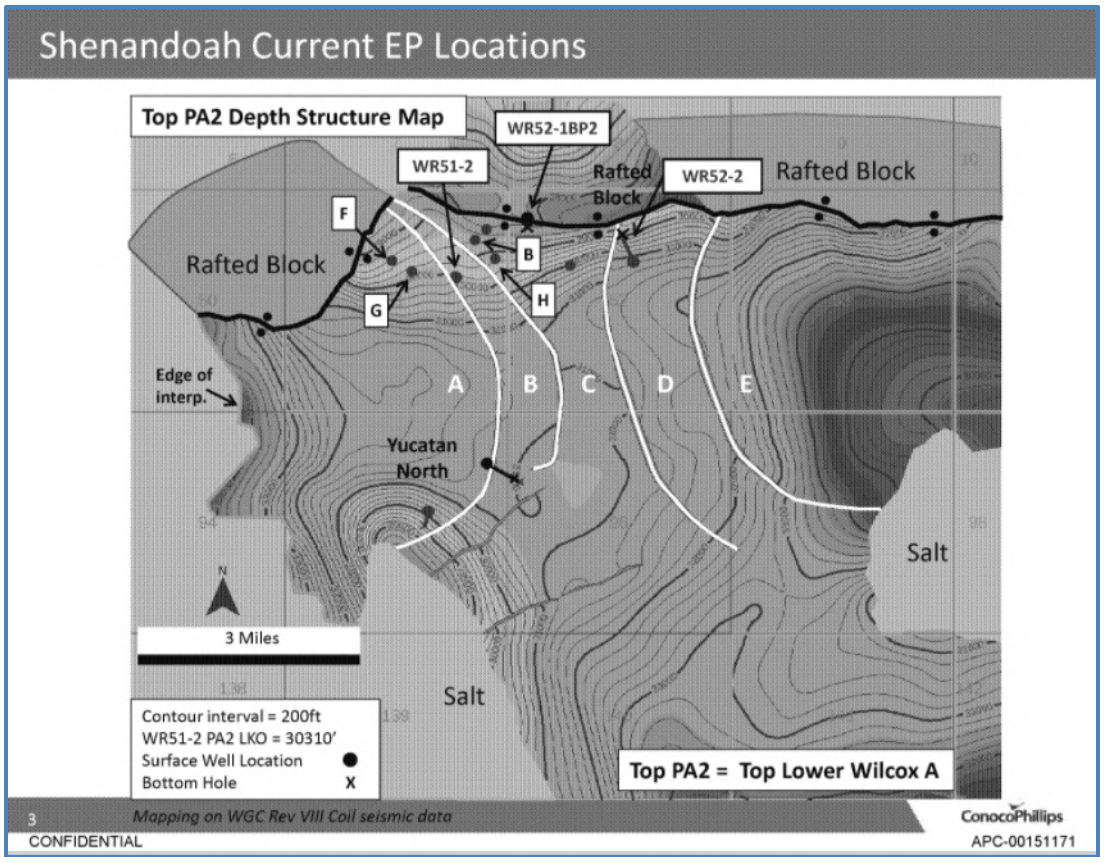

Exhibit 21: COP's Interpretation of Faulting (12/10/14)

105. At this meeting, Venari presented a summary slide:[81] "*Current seismic interpretation indicates that faulting may compartmentalize the Shenandoah field*." Partner Cobalt includes "Reservoir Segmentation by Faults" as one of its key uncertainties.[82] At this stage of the appraisal of the Shen discovery, most partners plus Anadarko's Development team agreed that compartmentalization from faulting was a major risk to the project.

106. Hollek updated Kleckner in an email[83] that partners were displeased with how Exploration was not working with partners on targeting Shen-4 to provide the most amount of information. COP also indicated that Development needed to be present in future partner meetings targeting wells, apparently expressing frustration in Exploration's performance.

> *"According to Pat the Exploration meeting with Shenandoah Partners did not go well at all. Conoco called them out about not working with the partners at all on the next location. It was determined that we only have 3 locations with approved EP's and they are all in the same area around Exploration's location. Therefore, could not drill a safer location if wanted to. Pat indicated that only Marathon was content with location. Venari, Conoco and Cobalt all wanted a more easterly*

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81 APC-00151164 dated 12/16/14, page 3 APC-00151165.

82 APC-00018113 dated 12/11/14, page 2 APC-00018117.

83 APC-00150647 dated 12/15/14.

> *location to develop critical mass. Conoco explicitly indicated that Development and Exploration needed to be in future meeting to ensure our next well is getting us closer or to a minimal field size."*

107. Wilkens prepared a file[84] listing eight zones in the Shen-3BP1 core that showed deformation bands, providing strong evidence of faulting within the well. Deformation bands can signify small faults with very small displacements. Within porous sandstone, stress can deform the rock to shift the packing of the sand grains and crush the sand grains, resulting in much lower permeability and porosity. Hence, deformation bands do not require large displacements along a fault to form a barrier or restriction to flow.

108. Following a Development team discussion of geologic and geophysical concerns, Oudin states[85] as follows that faulting was his primary concern:

> *"Compartmentalization – primarily faulting, but also evidence from wells in basin for variable sand thicknesses (stratigraphic pinchouts?). Seismic evidence for faulting away from structure, also evidence that Yucatan deep structure is faulted; what is likelihood that faults extend onto and segment structure?"*

109. McGrievy summarizes to Oudin in an email[86] the results of a meeting on Shen-4 with Daniels, his direct reports, and Kleckner. At that meeting, some VPs expressed concern that Exploration's P99 was too large. In my opinion, this concern was salient given the known risk of fault-related compartmentalization potentially limiting the eastern extent of the oil accumulation. McGrievy emailed Oudin on January 16, 2015:

> *"It was clear yesterday that the explorationists wanted to convey the message that they have been working with our team to develop a reasonable collective interpretation (agreement on the central north-south fault) that both teams can support at this point. Chris Camden also talked about the OWC contacts being about ~200 ft updip of the Shen 3 location as per their interpretation but he did acknowledge that there could be multiple interpretations and that his interpretation is not absolute.* ***There was some concerns from the VP's that the P99 of their resource distribution is too high; they did revised it down to 475 MMBOE but if we believed this, it would be sanctionable and would still be the largest APC field discovered****."* (Emphasis added.)

110. On January 19, 2015, Oudin wrote an email to Wilkins regarding an east-west trending fault he had interpreted just north of Shen-3. Exhibit 22 shows a seismic line[87] running NNW to SSE through the Shen-3 location. Given the potential for this fault to seal, Shen-3 was

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84 APC-00861953 dated 1/7/15.

85 APC-00020023 dated 1/13/15.

86 APC-00020506 dated 1/16/15.

87 APC-00863560 dated 1/19/15.

not located effectively to be an injection well and provide pressure maintenance to up-dip production wells to the north.

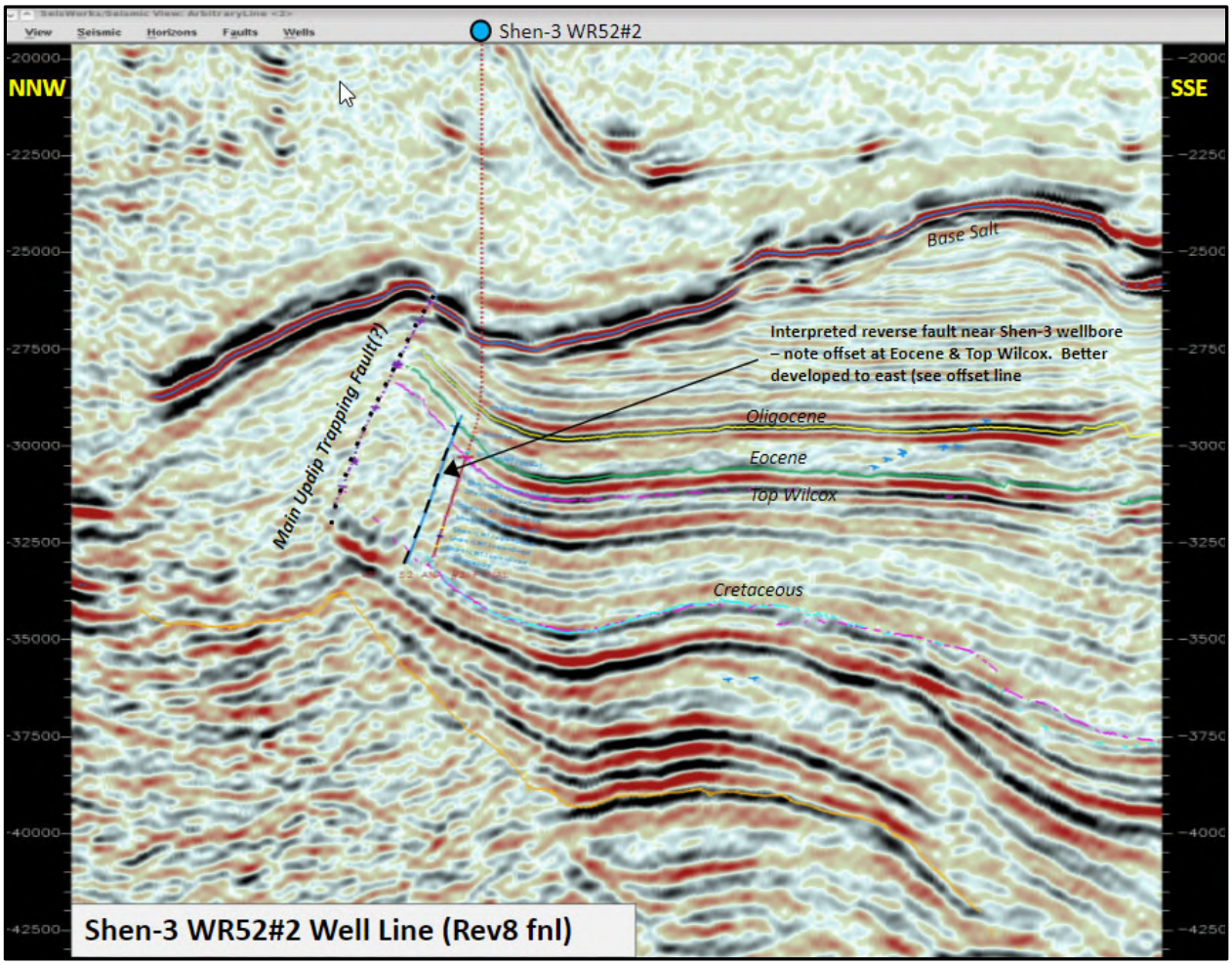

Exhibit 22: Interpreted Fault North of Shen-3

111. Shen-3 was also not suitable as an injection well at the time because it was not designed for that purpose. Oudin relayed this to Kendall in Exploration, as shown below.

> *"Subject: Shen 3 non-utility as Wilcox WI*
>
> *Beth, I checked with Lea and she said that Shen 3 cannot be utilized as a water injector given its current design. Chip"*[88]

112. Shotts prepared a presentation for late February 2015 in the file "Chopped v2 Shen RCRT COP, Feb 2015.pptm" in which he states on a summary slide:[89] "*Pressure data suggests multiple, vertically-stacked, horizons in separate compartments*" and "***Up-dip and down-dip wells separated by >1 mile; not in pressure communication.***" (Emphasis added.) Shotts' assertion that

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88 APC-00001928 dated 2/2/15.

89 APC-00000959 dated 2/18/15, page 3.

the two wells are not in communication runs entirely counter to Leyendecker's narrative that Shen-3 pressures determine OWCs for the field. In a slide on sensitivities, he stated: "*Compartmentalization & aquifer support are the most impactful subsurface uncertainties*."[90] His presentation also presented simulation results showing that including both north-south and east-west trending faults can reduce oil recovery efficiency in place from 26% in the Base Case to as low as 5%. This work was already presented to partners in August 2014.

113. Shotts' presentation was abruptly cancelled,[91] not long after Leyendecker complained to the manager for Shotts' group, Bob Talley:[92] "Robert, perhaps you can help the presenters with one of our core values – open communication."

114. In my expert opinion, a presentation of this sort is important technical work that invited useful discussion on a key risk factor, and there was no basis for keeping it confidential from others within the same company. The exchange showed Leyendecker's efforts to censor technical opinions and prevent open communication that ran counter to his preferred narrative, rather than the other way around. As Shotts put it:[93]

> *"Shotts, Doug [7:53 AM]: Word came from down from Talley that the Exploration SVP was not happy with the content. Apparently, an open technical discussion is not something we like to do here (hint of sarcasm)."*

115. Shotts was not the only person frustrated by censorship. Oudin wrote a sarcastic email[94] to Shotts and Frye about the effort to cancel Shott's presentation:

> *"Doug,*
>
> *I saw your upcoming presentation on lnsider (and also on the Elevision) and was wondering if you could make some small adjustments to your talk. I noticed on your cover page that you used the phrases 'challenging problems,' 'unmapped barriers,' and 'uncertainty parameters,' could you please remove them all, as they imply a certain negativity about Shenandoah that is not truly warranted at this time, especially for a discovery that may be one of Anadarko's all-time largest ever. lf you have any references to faults in your presentation – as barriers, either unmapped or mapped – please refrain from calling them 'faults,' referring to them instead as 'hypothetical lineaments with potential for full transmissibility.' ln fact, you should probably change the title of your talk; 'Dynamic Uncertainty' is too strong and too negative a phrase for a discovery that is probably one of Anadarko's all-time greatest.*

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90 Same, page 7.

91 APC-00000957 dated 2/18/15; Doug Shotts Deposition dated 6/29/22, page 155, line 18 to page 156, line 4 ("at the – final hour, it was cancelled").

92 APC-00865081 dated 2/17/15.

93 APC-00162693 dated 2/19/15.

94 APC-00002888 dated 2/17/15.

Sincerely,

(names withheld by request of 13th floor hall monitor)"

116. There was growing concern that Exploration's over-optimistic assumptions and the lack of transparency were creating a misimpression that Minimum Economic Field Size (MEFS) would be reached by Shen-4. McGrievy emailed[95] Hollek about his concern about being straight with partners regarding the range of interpretations. The different interpretations relate to the role of faulting, the likelihood of pressure continuity between Shen-2 and Shen-3, and what did the pressure data in the Shen-3 water leg prove or not prove.

> *"I'd like to meet with you in advance of our meeting with Ernie and Company next Wednesday. I'm still concerned about our ability to be straight with our partnership on various alternative interpretations. We need to be transparent in order to reach consensus on a MEFS strategy and would like your thoughts on how we proceed. My guess, judging by the slide that Alan forwarded to you and I that they believe they will have reached MEFS with the next well."*

E. Lead Up to Shen-4

117. Following Shen-3, partners shared their structural models along with their mapped faults. Compared to Exploration's map with a single fault, COP, Venari, and Anadarko's Development Team mapped substantially more faults.

118. In a partner meeting on March 3, 2015, one of the presentation slides[96] compared each partner's structure maps, shown in Exhibit 23. The Anadarko map included one north-south fault, and no map representing the Development team's interpretation was shown. Both COP and Venari showed considerably more faulting. The assertion that Shen-3 pressures are likely to be in communication with Shen-2 across these mapped faults does not appear to be supported by several of these interpretations.

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95 APC-00023196 dated 2/19/15.

96 APC-00165815 dated 3/3/15, page 6.

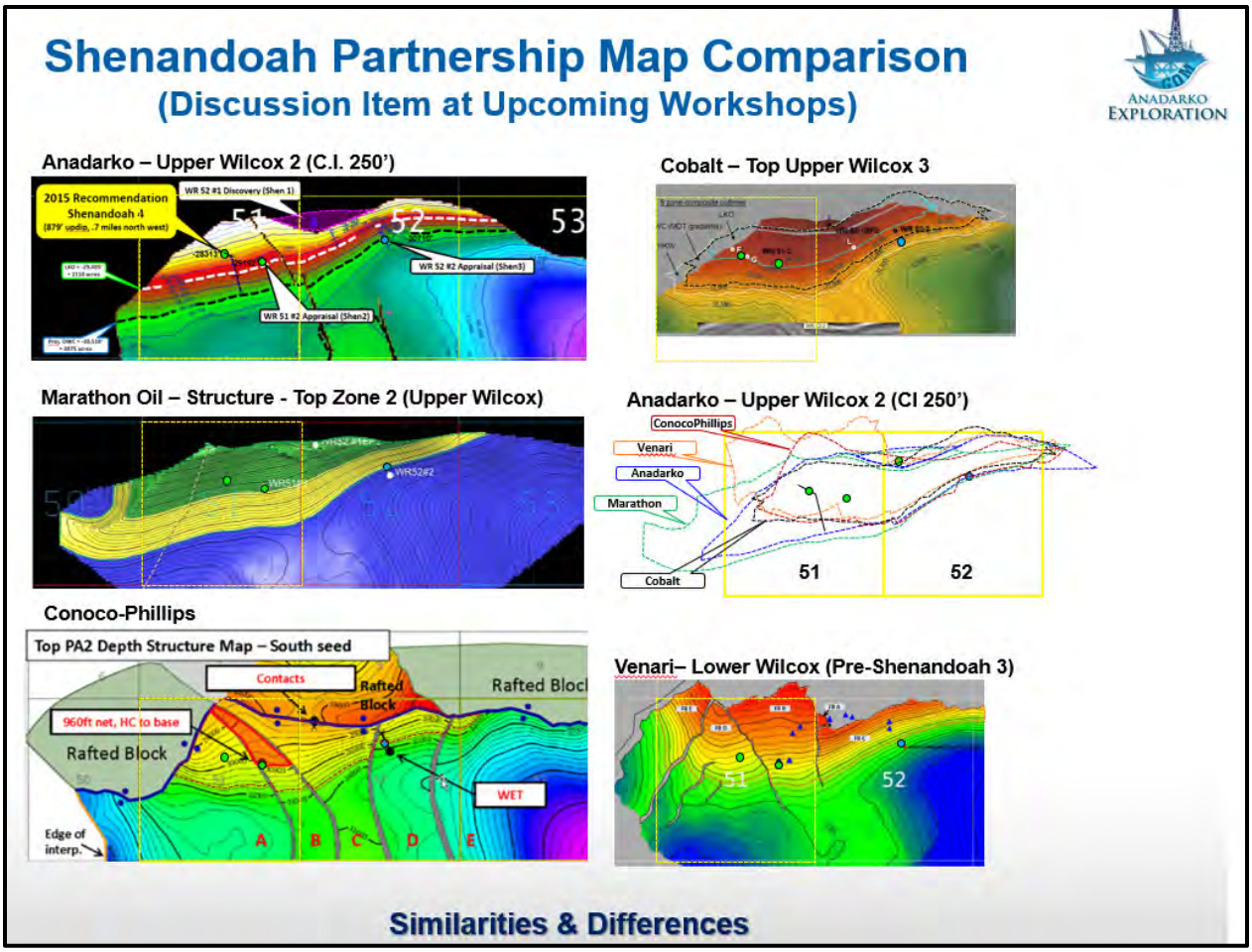

Exhibit 23: Comparison of Partner's Structural Maps (3/3/15)

119. In planning for a workshop with partners, Oudin wrote[97] to Frye about how to represent his interpretation of structure mapping versus Exploration's and mentioned, "*we are still a house divided*." The range in alternative faulting interpretations presented more risk and uncertainty than the Exploration map.

> *"Actually, I started to wordsmith this a bit and started wondering if this was going to get too far into Exploration's wheelhouse as originally written. Let's talk this through somewhat . . . . as much as I want to show my interpretations and thoughts, it might create issues with submitting new EP locations to the gov't (i.e. new maps), it might accentuate to partners that we are still a house divided, and it might open more cans of worms than I can think of now. I might actually be better off working from Expl maps and highlighting on them areas where I have, how do I say it politely, a difference of opinion, or where I see greater risk and uncertainty based on alternative interpretation concepts."*

[97] APC-00868591 dated 3/10/15, email chain.

120. In Oudin's June 30, 2022 deposition,[98] he confirmed that he had made his difference of opinion on fault interpretation known within Anadarko, stating, "*it had been on the table for a short while*":

> *"Q. And you were reluctant to show your interpretations and thoughts because "it might accentuate to partners that we are still a house divided"? That's what you wrote?*
>
> *A. Correct.*
>
> *Q. And do you mean by that, house divided between the exploration and development teams?*
>
> *A. Yes.*
>
> *Q. And you had, as you said it politely, a difference of opinion with the exploration team interpretations?*
>
> *A. Correct.*
>
> *Q. And you made that difference of opinion known internally at Anadarko; right?*
>
> *A. At about this time, it had been on the table for a short while."*

121. On April 15, 2015, Oudin announced[99] that his recent work on mapping the Cretaceous surface showed more faults than previously shown:

> *"Attached powerpoint illustrates some of the changes that I'm attempting to make to the current interpretation, for better or worse. I've shown examples for the Cretaceous surface, which is effectively our "basement" horizon for the Shenandoah model. You can see significantly more faults applied to the current interpretation, which are complicating (and delaying) output of a final set of horizons that tie together nicely and which terminate cohesively around the perimeter of the model area."*

122. A geologic modeling workshop[100] was held on April 30, 2015 providing a comparison of some partners' fault models. At this time, Anadarko Exploration's mapping included two faults, and the Development group's map is shown in Exhibit 24 with faults shown as red linear features. This map includes a complex set of faults ranging from north-south to east-west. COPC's geologic model included two faults in one scenario and no faults in the other,

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98 Chip Oudin Deposition dated 6/30/22, page 171, line 18 to page 172, line 8.

99 APC-00635302 dated 4/15/15, with maps in APC-00635303.

100 APC-00029360 dated 4/30/15.

accompanied by the following note: "*Likely to be additional faults . . . .*" Marathon's model included three faults.

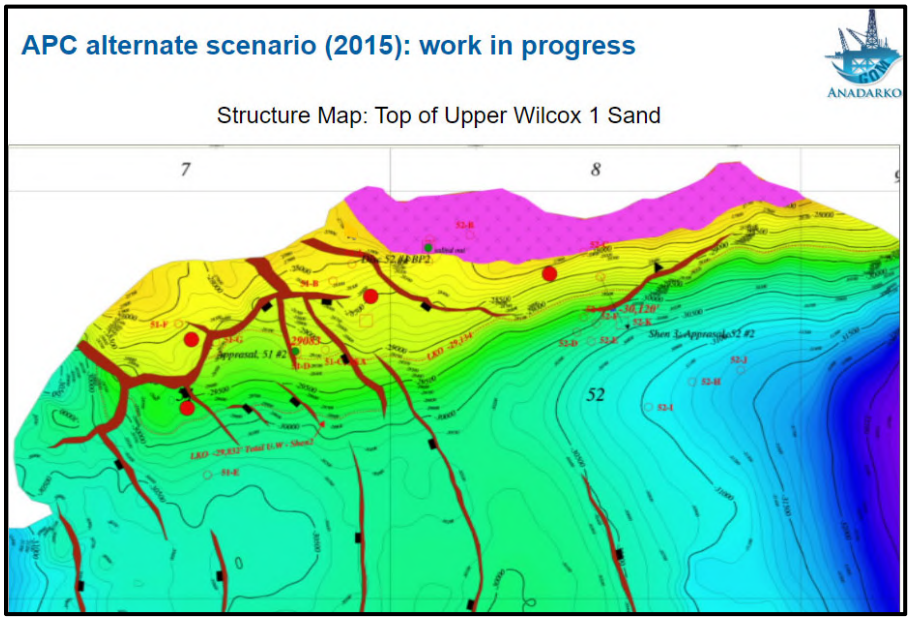

Exhibit 24: Development Team's Structural Interpretation (4/30/15)

123. On May 7, 2015, COP provided slides[101] of their geologic modeling. Their key elements summary stated that "***a faulted case [was] most likely***," shown in Exhibit 25. As a result of the complexity that faults presented, a range of uncertainty would exist for OWCs in untested blocks. This stance would make it highly unlikely that pressure continuity existed between Shen-2 and Shen-3, leaving the OWCs down-dip of Shen-2 unknown. The potential for having separate OWCs for each bounded fault block impacted how the results for the upcoming wells Shen-4, -5, and -6 were to be interpreted.

[101] APC-00030039 dated 5/7/15, pages 3 and 31.

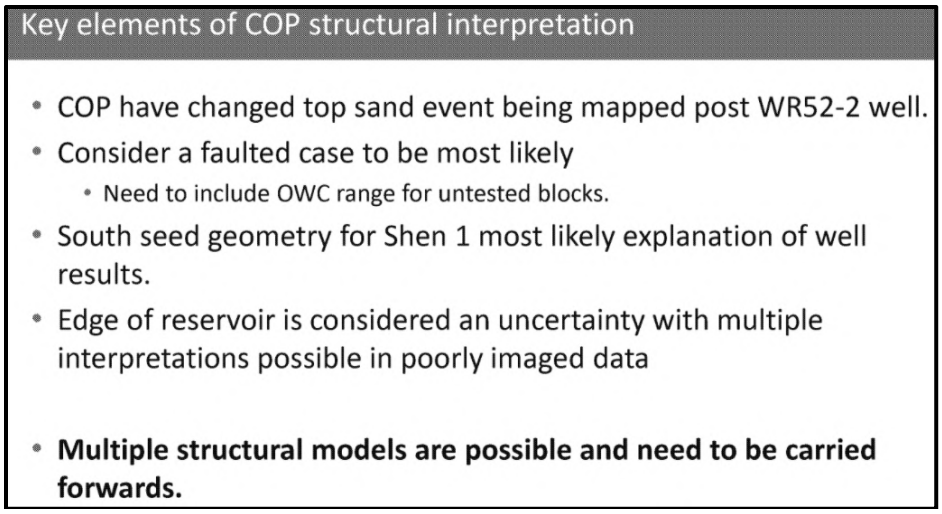

Exhibit 25: COP Key Elements of Structural Interpretation (5/7/15)

124. In an email dated August 15, 2015, Oudin wrote[102] to Chandler that if Shen-4 results were as complex as Shen-1, the "entire house of cards comes crashing down." In the same email chain, Ramsey informed the Exploration team that Shen-4 encountered Eocene salt similar to Shen-1 instead of the Wilcox sands. Oudin emailed[103] Chandler on August 15, 2015:

> *"Exploration may have backed themselves into a corner. We/they should expect nothing but Shen-2 type pays, because this entire project has been built on the premise that Shenandoah's type log for the entire structure is Shen-2. If Shen-4 looks like Shen-1 (or worse), then the entire house of cards comes crashing down. Sadly, if Shen-4 doesn't work, then Exploration will have destroyed whatever value Shenandoah had for APC."*

125. Oudin emailed[104] John Blackburn with COP regarding a cross-section that Trautman had sent to partners. The probable tone of sarcasm in the following quote addresses his disagreement that the Exploration team presented a cross-sectional model with no faulting between Shen-2 and Shen-4, despite numerous faults evident in the dipmeter. Oudin emailed Blackburn on August 17, 2015:

> *"Thanks, John. First I've seen of this. Glad to know (!?) that there are no faults in the Wilcox between Shen-4 and Shen-2, despite some interpretations that see faults galore in the Shen-4 dipmeter."*

126. Regarding the same cross-section,[105] Oudin shares with his team his concern that the structural model depicted by Exploration in Exhibit 26 included no faults between Shen-2 and

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[102] APC-00892430 dated 8/15/15.

[103] Same.

[104] APC-00642417 dated 8/17/15.

[105] APC-00045971 dated 8/17/15.

Shen-4 despite numerous faults identified in the dip meter as follows. Oudin emailed[106] McGrievy and the team on August 17, 205:

> *"Got this from COP, or should I say from Exploration via COP. Interesting to note that the Wilcox sands are unfaulted between Shen-2 and Shen-4, despite some evidence of faulting in the Shen-4 dipmeter. What did Paul say on Saturday? Oh, yeah . . . 'Hope springs eternal.'"*

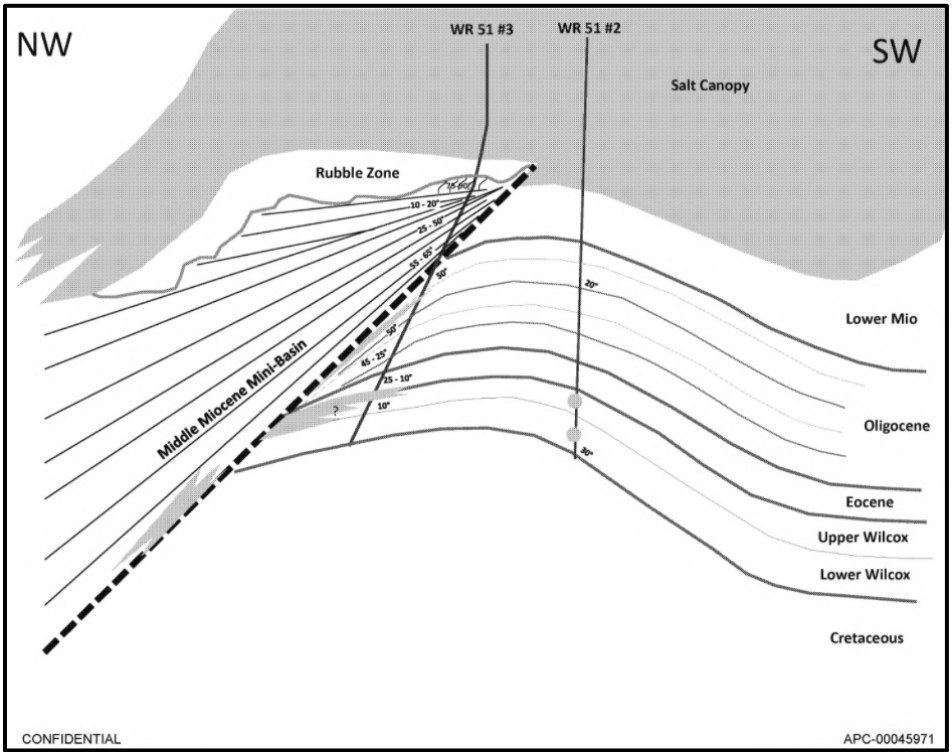

Exhibit 26: Exploration Cross Section Showing No Faults Between Shen-2 and Shen-4 (8/17/15)

127. In an email[107] dated August 26, 2015, the Development team appeared to be leading discussions with partners regarding the appraisal strategy determining the target area of the upcoming well Shen-5. Oudin wrote to Blackburn and Chernoff at COP to explain his reasoning for preferring Location WR52-L. Once again, a tone of sarcasm was expressed in his hopes that certain people, likely Leyendecker's Exploration team, might be developing an appreciation for the complexity faulting was having on their appraisal results:

> *"The WR51-E location is a safer well, with best potential for a Shen-2 lookalike, fault-separated and 500'-600' up-structure from Shen-2; my concern is whether it may be separated from resources further east by a fault (or fault system) that is poorly-defined, perhaps more conceptual at this point.* ***But I'm hoping that certain folks are starting to believe that we do indeed have faults at Shenandoah that are complicating the structure****, so I'm looking at all possibilities and trying to see*

[106] APC-00045970 dated 8/17/15.

[107] APC-00047057 dated 8/26/15.

which well will have the greatest impact. Right now that well is WR52-L." (Emphasis added.)

F. Shen-4 Results

128. Shen-4 results confirmed small-scale faulting and compartmentalization to the point of being described as a "busted up" reservoir,[108] and resulted in a one-third reduction in the field's resource size. The economic impact of Shen-4 was profound, as the estimated resource volume was getting smaller and more complex with each appraisal well and the downside impact of fault compartmentalization had made Shen uncommercial. Anadarko began pursuing an exit strategy. These economics will be discussed in more detail in Section IV, and my conclusions about the technical results are as follows:

(a) Considering that most of the Upper Wilcox sands were missing, encountering a wet LWD sand and 14 ft. of wet sands in the LWE was very significant and was not "full to base." In my expert opinion, the industry standard usage of "full to base" would mean that all sands were oil bearing, and "full to base" does not mean that some sands were oil bearing and others water bearing. It is also inaccurate to state that no water was encountered at Shen-4 ST, or that it was all oil.

(b) Based on pressures, Shen-4ST1 was in a separate pressure compartment from Shen-2. Pressures in the bypass core even showed that the sidetrack and bypass well to be in separate pressure compartments, despite being just 300-400 ft. apart.

(c) The reservoir quality was not good at Shen-4. Most of the Upper Wilcox sands were missing, and both the LWD and LWE sands were poorly developed and substantially lower in sand quality, as described in the AFE form dated September 31, 2015 and reviewed by Daniels.

(d) Core analysis identified nine different faults in the core alone.

129. The loss of one third of oil in place was a significant blow to the project. McGrievy writes to staff in an email that Shen-4 had encountered the basin margin instead of the intended Wilcox sands. More importantly, the new location of the basin margin reduced the estimated oil in place for the field by one-third as shown below. McGrievy also confirmed that Kleckner would be informed of these developments, making for an interesting discussion with senior management. McGrievy emailed[109] staff on August 28, 2015:

"Please keep a tight lid on this but we were hoping to drill the Wilcox section last night and today but found, instead, the basin margin as we are currently drilling salt and will probably TD the well This evening as it appears that we are drilling a salt stock. Preliminary estimates as per some quick updates to the Geomodel by Christian Noll, assuming that we are close to the Wilcox HC sediment interface, is ***a loss of almost 1bboe or about 1/3rd of the pre-drill STOIPS (3.2 bboe)****. Our*

[108] APC-00665447.

[109] APC-00047448 dated 8/28/15.

> *estimates now are approximately 2.3 bboe in place.* ***This outcome may have a profound effect on how we view this project going forward and our update with Jim Kleckner will definitely be an interesting one****."* (Emphasis added.)

130. The loss of one-third of the oil in place was significant enough to change the focus of the Shen evaluation to considering slow-down options and exit strategies. In the same email chain,[110] Frye stated the following:

> *"Wednesday Meeting – I think . . . but we can confirm with Pat today that we really just need to talk through different slow down options and the impacts on budget, execution, and 1st oil. Think about and [sic] exit strategy and what that looks like. What we might be prepared to show Bob and Jim."*

131. The negative impacts of the Shen-4 results were presented to senior management on September 9, 2015 in a file[111] named "Shenandoah_Kleckner_budget_09-09-2015_v3 (2) .pptx" and shown in Exhibit 27 below. The loss of one-third of mapped oil in place was a significant adverse finding, as was a six-month plus delay was a major setback to the Shen project.

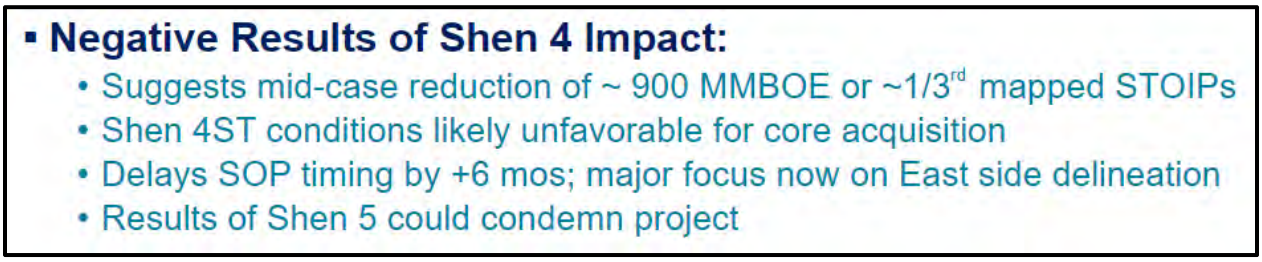

Exhibit 27: Negative Results of Shen-4 Impact (9/9/15)

132. By September 24, 2015, Kleckner[112] was already discussing exit strategy options for an Executive Committee offsite as follows in Exhibit 28:

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[110] Same, dated 8/31/15.

[111] APC-00193551 dated 9/9/15, emailed to Kleckner in APC-00193550 dated 9/9/15.

[112] APC-00196222 dated 9/24/15, file name "EC Offsite - Sept 2015 additional.pptx" attached to email APC-00966221.

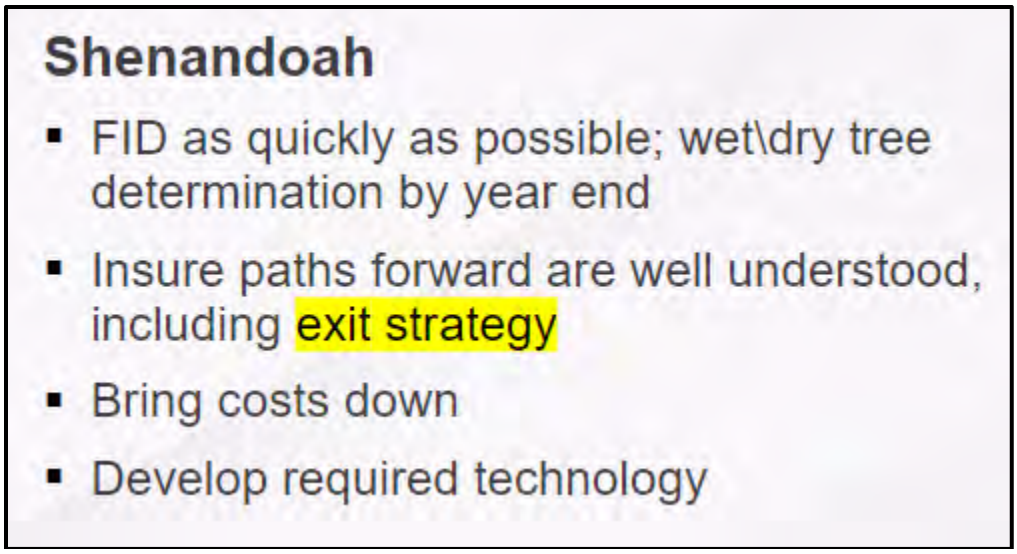

Exhibit 28: Shenandoah Exit Strategy (9/24/15)

133. There were several important findings that centered on the complexity faulting caused. The entire Upper Wilcox section was faulted out in the Shen-4 sidetrack (ST1), as discussed in a partner meeting the previous day. Another important finding was the total of high-quality net pay of only 380 ft. compared to the net pay of 1,000 ft. in Shen-2. In addition, the LWC, LWD, and LWE contained 200 ft. of lower quality net pay, which was a significant finding that could impact assumptions of lateral continuity. McGrievy emailed[113] Kleckner on September 24, 2015:

> *"We hosted a meeting with the partnership this afternoon and the prevailing belief is that we cut either an NE-SW (APC interpretation) or E-W (Venari) trending fault, at or near the top of the UW1 sand, effectively faulting out the entire Upper Wilcox section which we believe contains approximately 50% of our reserves at Shenandoah.*
>
> *We have approximately 380 ft of net TVD high-quality pay in the LWA and LWB and possibly as much as 200' of lower quality pay in the LWC, LWD and E, consistent with what was discovered in the Shen 2 well. At this point the net TVD pay counts are subject to conventional logging results as these net pays are from the LWD."*

134. An approved AFE form[114] dated September 30, 2015 and reviewed by Daniels stated that the Shen-ST1 encountered lower quality pay in the LWD and LWE sands, and the Upper Wilcox sands were missing due to faulting. In addition, the LWD was wet and the LWE sand appeared to be wet and/or low porosity. The document is quoted below:

> *"THE LOWER WILCOX A, B AND C SANDS WERE ALL FOUND TO BE PRESENT AND HYDROCARBON FILLED. THE LOWER WILCOX D SAND*

[113] APC-00049208 dated 9/24/15.

[114] APC-00001914 dated 9/30/15.

APPEARS TO BE WET/AND OR LOW POROSITY AND THE LOWER WILCOX E SAND APPEARS TO BE A MIX OF HYDROCARBONS AND WATER. THE UPPER WILCOX 2 & 3 SANDS APPEAR TO BE SHALED OUT OR MISSING DUE TO FAULTING."

135. MDT logs in the Shen-4ST1 establish that the Shen-4ST1 and Shen-2 are in separate pressure compartments, most likely due to faulting. In the Upper Wilcox, LWA, and LWB sands, the pressure difference[115] was 60-85 psi. The difference was greater in the LWC through LWE sands at 200-220 psi.

136. In addition, the wellsite geologist identified slickensides in the bottomhole cuttings that returned to the surface. A slickenside is a rock with a polished surface formed by movement along two sides of a fault, normally showing striations. This observation added yet another source of evidence for faulting within the reservoir. The report[116] from the well site geologist is as follows:

"Please be informed that I have revisited the cuttings yesterday and I have noticed possible slickensides in the cuttings, please see the attached slides."

137. The evidence for extensive faulting was substantial, as listed in Exhibit 29 from a Shen-4 update meeting presentation.[117] With evidence from multiple sources, ranging from wireline surveys, paleo data, faults in cores, Upper Wilcox sands missing in Shen-4ST1 and ST1BP, and pressure separation between Shen-4ST1 and Shen-2, this appraisal well proved the existence of a complex network of faulting, as summarized in Exhibit 29.

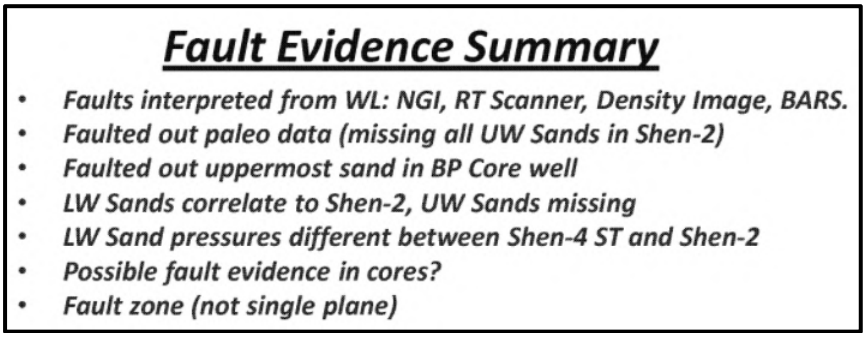

Exhibit 29: Multiple Source of Information Confirming Faulting (11/30/15)

138. Reacting to the news that the Shen-4ST1 well was in an isolated compartment based on pressures, Oudin raised the question[118] of what can be done to sanction with confidence when the reservoir is compartmentalized, but the size of the compartments remains unknown. In my expert opinion, this question directly addressed the most serious challenge faced by the team's appraising the Shen field. His question is as follows:

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[115] APC-01351563 dated 2/17/16, page 39.

[116] APC-00653361 dated 11/3/15.

[117] APC-01701787 dated 11/30/15, page 20.

[118] APC-00648863 dated 10/6/15.

"Serious thought to consider (and I know you didn't think I was capable of them) [. . .] how do you go forward with project sanction when you know your reservoir is compartmentalized, but you don't know how big your compartments are?" (Emphasis added.)

139. Brad Browning made a similar comment[119] a year and one-half earlier:

*"**Is the reservoir completely broken up by faulting or noisy data?***

I wonder if we'll know which is the case until a good number of wells are on production.

But certainly, if we get more pressure breaks between appraisal wells, we'll have our answer.

Thanks." (Emphasis added.)

140. With Shen-4ST1 in its own pressure compartment, all Shen wells with oil pay have proved to be pressure isolated from one another. Shen-1BP2, Shen-2, and Shen-4ST1 have proved to be isolated from one another, providing at least part of the answer to Brad's question of whether the reservoir is completely broken up by faulting.

141. Wilkens[120] identified a total of nine faults in the Shen-4BP1 cores and made the following observations on deformation bands observed in cores 1 and 2:

- *"Most clean sands contain deformation bands*
- *Numerous wide clusters of bands, which is different from the Shen 3 core, indicating enhanced levels of (shear) strain and closer proximity to major faults."*

142. A Foldbelt Asset Team Update[121] labeled "Abendshein Update" and dated December 2, 2015 provided the following assessment of whether overall Shen-4 results were favorable or disappointing as follows: "***Sanction pushed bqack [sic] 5 months as result of disappointing appraisal efforts on Shen 4, Shen 4ST***." (Emphasis added.) The delay of a multi-billion dollar project by five months is a significant and negative development.

143. Another downside of the well was that Shen-4ST1 encountered lower quality sands in the LWC, LWD and LWE as discussed above. The impact was significant enough that Frye, Shotts and Prosser collaborated on a sensitivity case in which some or all zones were excluded

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[119] APC-00004880 dated 3/31/14.

[120] APC-01006567 dated 12/1/15, page 3.

[121] APC-01350202 dated 12/2/15.

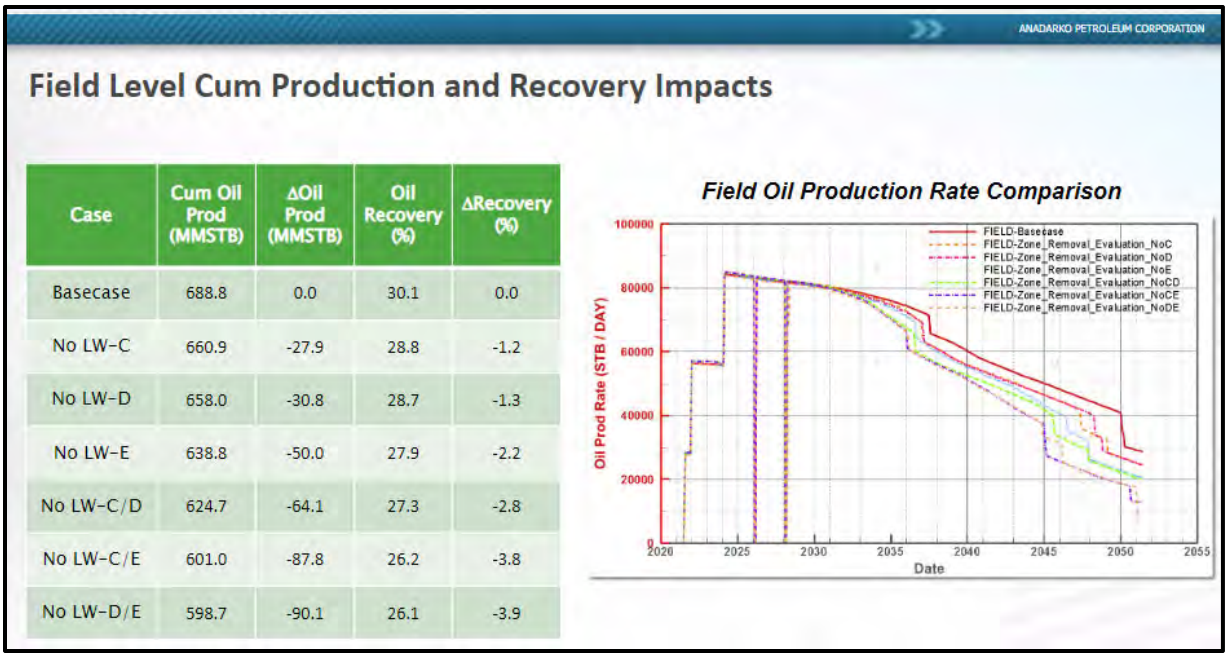
from development in the reservoir simulation scenario. Prosser is quoted below[122] addressing how zone exclusion might vary across the field.

> *"I like all the information Doug has incorporated. The only scenario I would maybe like to see is No LW-C-D-E.*
>
> *This is probably a later sensitivity because it may just be a waste of time depending on Shen 5 results, but it would be interesting to see No LW-C-D-E on the Western portion of the field, and from Shen 2 to the east maybe just leave out LW-D-E.*
>
> *What do you think?"*

144. The sensitivity runs completed by Shotts evaluated the loss of resource by excluding deeper, marginal zones and are summarized in Exhibit 30 below. Leaving out one or two of these lower-quality sands had a relatively small impact on recovery. For example, leaving out the LWC sand resulted in a loss of only 1.2% of oil in place. With the UW 1-3 zones missing in the Shen-4BP1 bypass well, ***that leaves only the LWA and LWB as attractive target zones in this part of the field***. The author did not find any documents establishing that these results were discussed with management, but the slides were included in a file[123] for a partner meeting. The exclusion of oil-bearing zones was not assumed in any of the resource estimates apart from this study.

[122] APC-00056272 dated 12/3/15, with slide from APC-00056264, page 5.

[123] APC-00233134 dated 3/23/16, titled "2016_3_23_Subsurface_Final_Version_Partners.pptx," page 47, attached to APC-00233133 dated 3/22/16.



Case	Cum Oil Prod (MMSTB)	ΔOil Prod (MMSTB)	Oil Recovery (%)	ΔRecovery (%)
Basecase	688.8	0.0	30.1	0.0
No LW-C	660.9	-27.9	28.8	-1.2
No LW-D	658.0	-30.8	28.7	-1.3
No LW-E	638.8	-50.0	27.9	-2.2
No LW-C/D	624.7	-64.1	27.3	-2.8
No LW-C/E	601.0	-87.8	26.2	-3.8
No LW-D/E	598.7	-90.1	26.1	-3.9

Exhibit 30: Production Impacts of Not Producing Lower Wilcox C, D or E Sands

145. A partner meeting[124] on December 16, 2015 showed a slide in Exhibit 31 that provides a valuable summary of the impact of Shen-4, Shen-4ST1, and Shen-4ST1BP. As stated earlier, the original Shen-4 well encountered salt and the basin margin, reducing the estimated oil by one-third. Substantial differences over such a short distance between Shen-4ST1 and the bypass core revealed a high degree of fault complexity on the western flank, warning of potential structural complexity in the eastern half of the field. These negative findings resulted in a substantial delay in a key milestone.

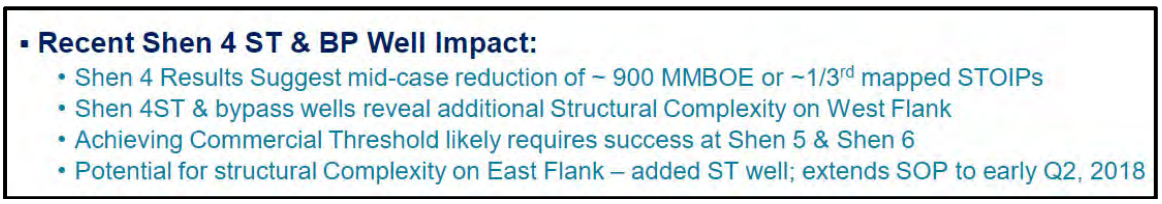


Exhibit 31: Results From Shen-4 Wellbores (12/16/15)

146. A comparison of Exploration structure maps[125] pre-and post-Shen-4 in Exhibits 32 and 33 is quite illustrative of the complexity added to the western half from Shen-4 but not yet taken into account in the eastern half of the field. Before Shen-4, the Exploration map included a single north-south fault crossing the oil accumulation, shown as the grey linear feature. After the Shen-4, Shen-4ST1, and Shen-4ST1BP wellbores were drilled, the map required three faults within a mile of each other to accommodate the anomalous findings, along with a substantial contraction of the northwestern edge of the reservoir. The eastern half of the oil accumulation on the Exploration map remained unfaulted. In my expert opinion, given the amount of evidence on

[124] APC-01160608 dated 12/16/15, page 5.

[125] APC-01702197 dated 1/11/16, pages 3 and 6.

complex faulting added by Shen-4, an assumption of no faulting in the eastern half of the structure appears unreasonably optimistic.

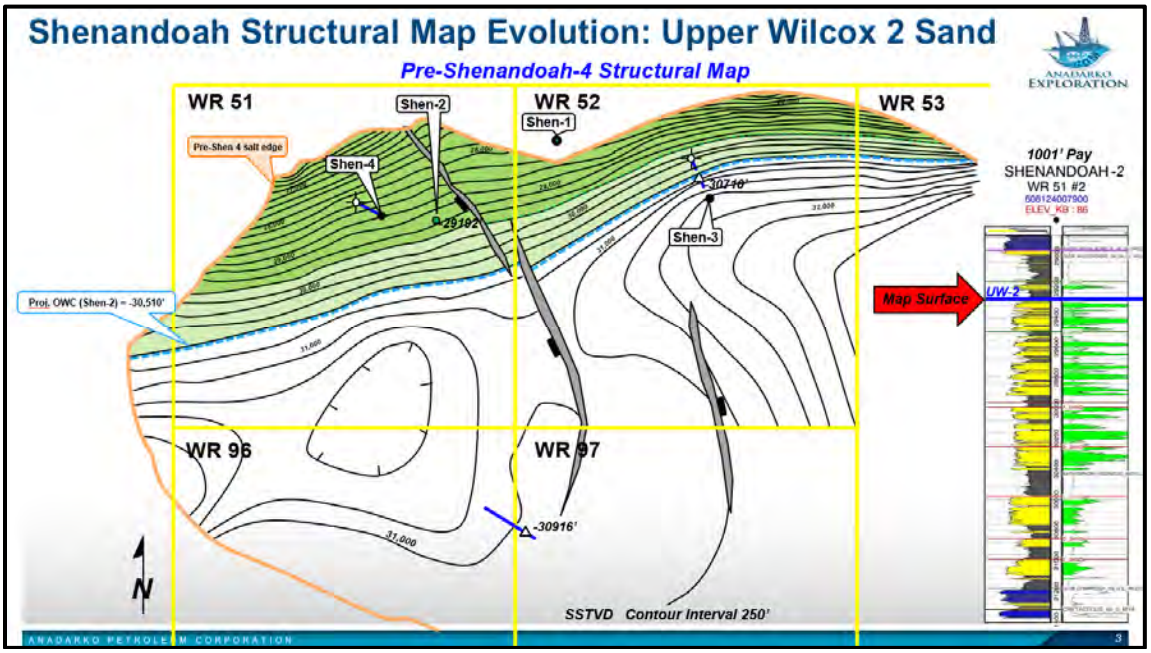


Exhibit 32: Pre Shen-4 Structural Map

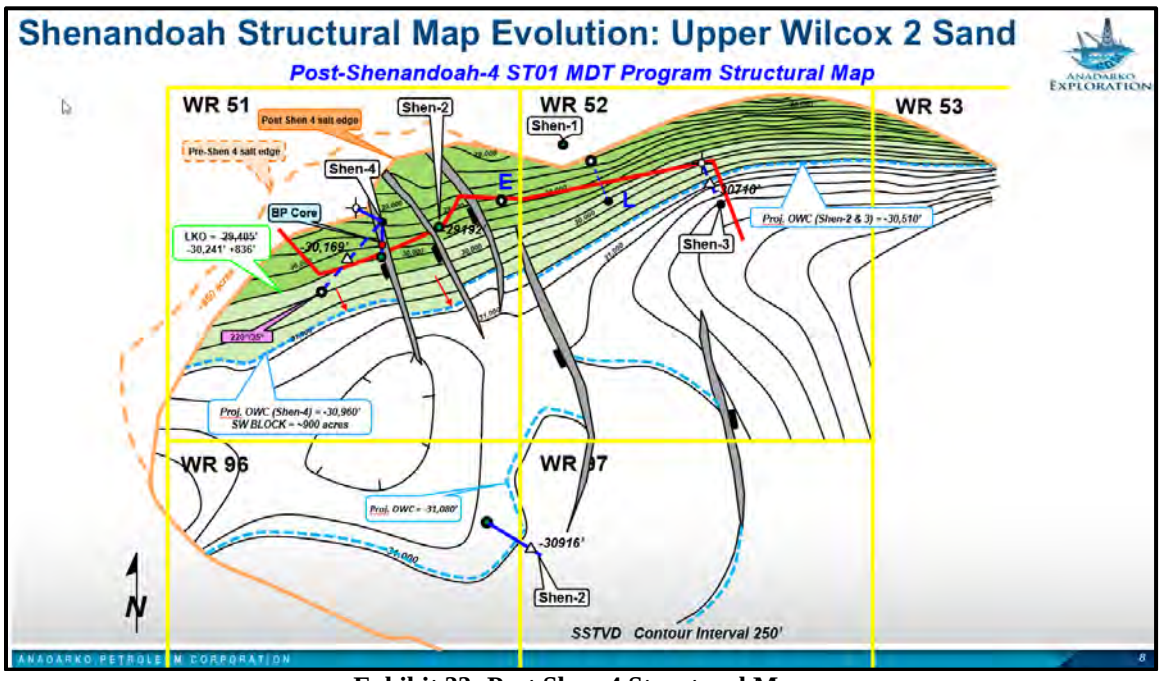


Exhibit 33: Post Shen-4 Structural Map

147. McGrievy identifies in a later email[126] his main concerns with the differences in resource assessment between the Development and Exploration teams. By assuming no fault

[126] APC-00059603 dated 1/10/16.

barriers to the east and OWCs extrapolated from Shen-3 pressures, Exploration's P90[127] oil in place estimate at the time was five times larger than the Development Team's P90 estimate. Such a large difference between two technical teams supposedly working together and accessing the same data does not seem plausible and a red flag for senior management. However, given Leyendecker's long record of opposition to the consideration of faulting, management interference may be a more likely explanation for the significant difference.

148. The Risk Consistency Team (RCT) facilitated a meeting on January 11, 2016 between the Exploration and Development teams to resolve their differences. From meeting notes,[128] Exploration's post-Shen-4 estimate of the mean recoverable resource before the meeting was 755 MMBOE, and Development's estimate was a much smaller 304 MMBOE. An insightful comment regarding faulting is as follows:

> *"Chip Oudin: The Shen-4 series of wells has been eye-opening and extremely valuable in terms of defining basin edge and in terms of the complexities that are going on with the sands. Now we need to understand the east side of the field."*

149. A joint final model supported by both technical teams was described in an email[129] from Frye to McGrievy and the team on January 13, 2016 and shown in Exhibit 34. The final mean resource estimate supported by both teams was 426 MMBOE. Frye states the following:

> *"Please find attached the joint exploration and development resource distribution and MMRA summary. The two groups met this morning and came to agreement on the Multi-zone Method derived resources. This was a compromise between the two groups on methodology and on the low side of the distribution. While the exploration group still believes the low side is too low and the development group stills believes the low side is too high, we agreed to go forward with the Multi-zone Method of combining two MMRAs, one for the West side of the field and one for the East side of the field, and applying some risk that the East side of Shenandoah could fail entirely. Over all, we are pleased with the end result."*

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[127] A P90 estimate for a distribution represents the value that 90% of the data set will be larger than.

[128] APC-01702198 dated 1/11/16.

[129] APC-00663563 dated 1/13/16, with figure from APC-00663564 dated 1/13/16, page 1.

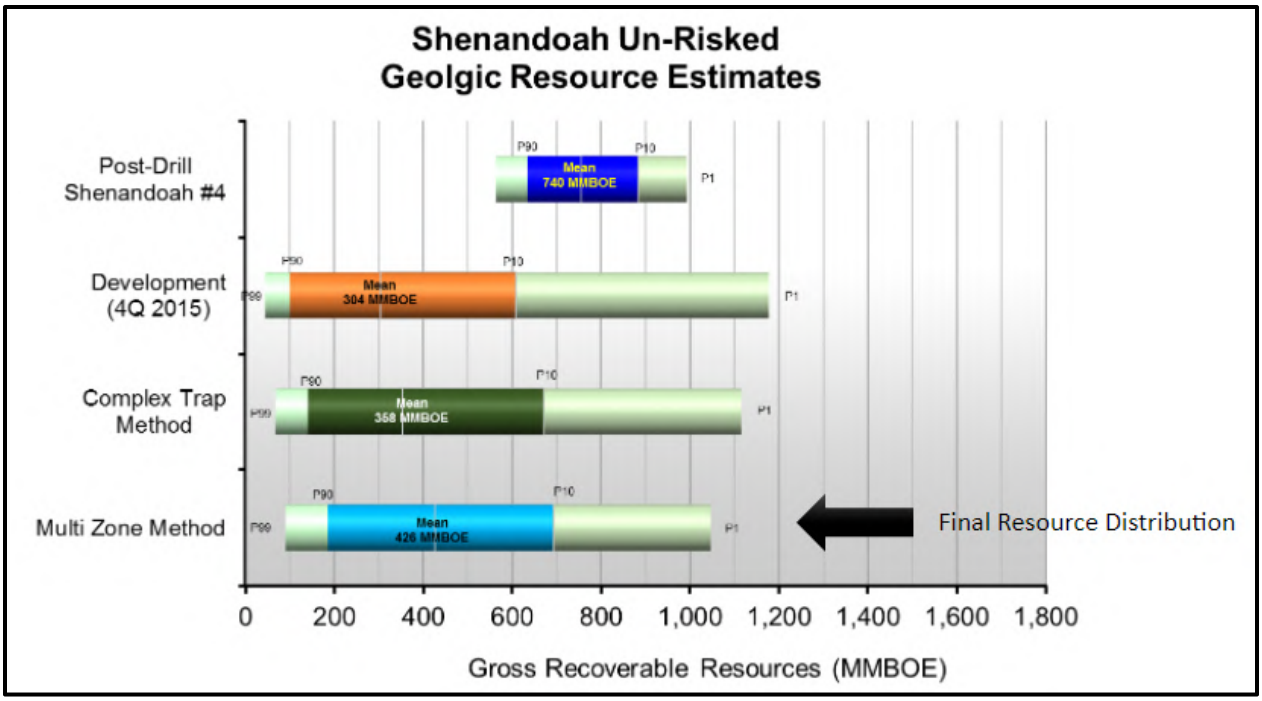

Exhibit 34: Trend in Resource Estimates (1/13/16)

150. Camden agrees[130] that a pressure shift exists between the two wellbores and that they were drilled in a faulted area, which is important because it indicates that fault compartmentalization occurs over short distances. He also stated that the Shen-3 aquifer was not connected to the western side of the field.

> *"Yes, there is a pressure shift between the S/T and the By-pass core wellbores – which would indicate some sort of compartmentalization. We believe the area where we placed the Shen #4 wellbore(s) to be fairly complex and faulted up a bit.*
>
> *Also, I also am using the Yuc#2 aquifer pressures to estimate OWCs. I don't think the Shen #3 aquifer is connected to the western side of the field."*

151. A petrophysical analysis comparing Shen-4 ST1 to ST1BP in Exhibit 35 shows substantial differences in wellbores located only 400 ft. apart based on a post-Shen-4 presentation[131] with partners. The figure below compares the results for both wellbores. Net oil pay was 626 ft. in ST1 but only 473 ft. in the nearby bypass core, 24% less. In other words, moving 400 ft.[132] laterally from the ST1 to the BP core resulted in the loss of 153 ft. oil pay. Part of the UW2 sand was present in ST1 but missing in ST1BP. The LWD was wet in both wellbores, but the LWE and LWF sands were faulted or pinched out in the ST1BP wellbore. The source rock for the LWE sands also changed in the short distance from the ST1 and BP1 wellbores. Chandler

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130 APC-00060671 dated 1/21/16, page 1.

131 APC-01351563 dated 2/17/16, page 5.

132 APC-01160608 dated 12/16/15, page 8.

wrote:[133] "*Something happened between these two boreholes to dramatically change the rock type regarding the LWE.*"

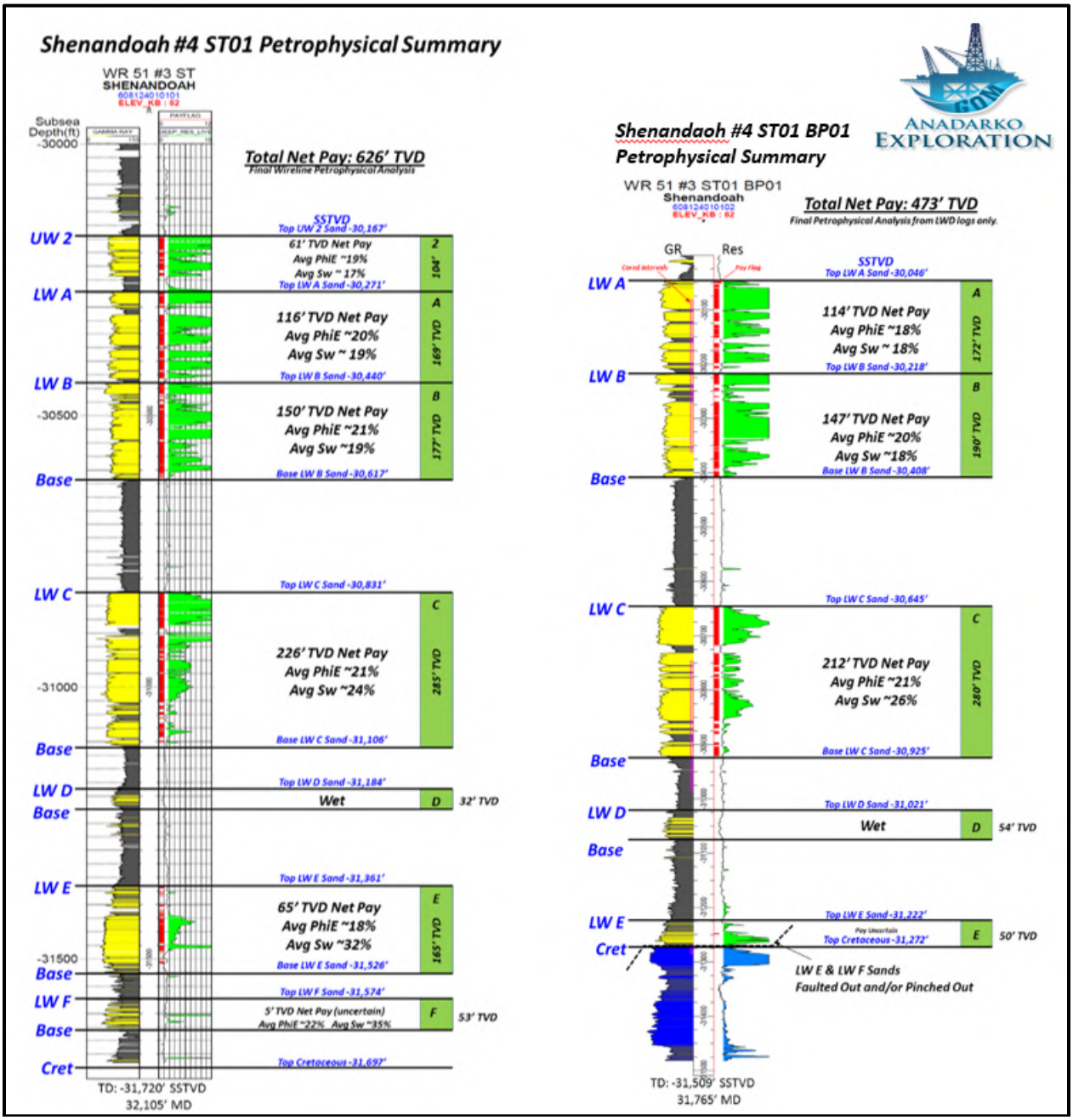

Exhibit 35: Comparison of Shen-4 ST1 and BP1 Net Pay (2/17/16)

152. In my expert opinion, complex faulting was the most probable cause for such stark differences over such a short distance. The pressure isolation between Shen-2, Shen-4ST1 and Shen-4ST1BP1 added additional weight to the argument for extraordinary fault complexity in the Shen reservoir. Given the weight of this evidence, in my expert opinion, it is improbable that

[133] APC-00060803 dated 1/21/16, page 1.

aquifer pressures in Shen-3 and Yucatan-2 had any relevance in determining OWCs in isolated fault blocks.

G. Shen-5 Results

153. Results from Shen-5 added weight to the argument for extensive compartmentalization from faulting. Shen-5 pressures were lower than in Shen-1, Shen-2, and She--4ST1, establishing another isolated fault block. At least 10 different pressure trends isolated vertically were observed in Shen-5, making this well the most vertically compartmentalized well in the field. For example, five separate pressure gradients were identified in the UW2 and UW3 intervals. A total of 22 ft. of tar was encountered in the LWC sands, raising doubt about the producibility of the entire LWC zone. The presence of tar also highlighted the risk of having unpredictable tar deposits within the reservoir destroying permeability. Lower gravity oils with lower gas to oil ratios (*i.e.*, lower quality oils) were also encountered in each of the Lower Wilcox zones, negatively impacting the potential recovery factor of these zones. The post-Shen-5 resource volumetric estimate decreased to 353 MMBOE, down 17% from the pre-Shen-5 joint model. Combined with the evidence from Shen-4 discussed above, compartmentalization and its negative impact on pressure support, recovery factor, and well count were abundantly evident.

154. Preliminary results were reported on June 2, 2016 for the Shen-5 well,[134] drilled to appraise the reservoir to the northeast of Shen-2 and west of Shen-3, as shown in Exhibit 36. The well encountered 1,043 ft. of oil-filled pay sands similar to Shen-2. Measured pressures were lower than in previous wells, confirming that Shen-5 is isolated from all other oil-bearing wells on the Shen structure. Fluids were more viscous with lower GORs, providing additional conformation of isolation from other wells. Findings are summarized in the lower right corner of the following exhibit:

[134] APC-00359319 dated 6/2/16, slide from page 2.

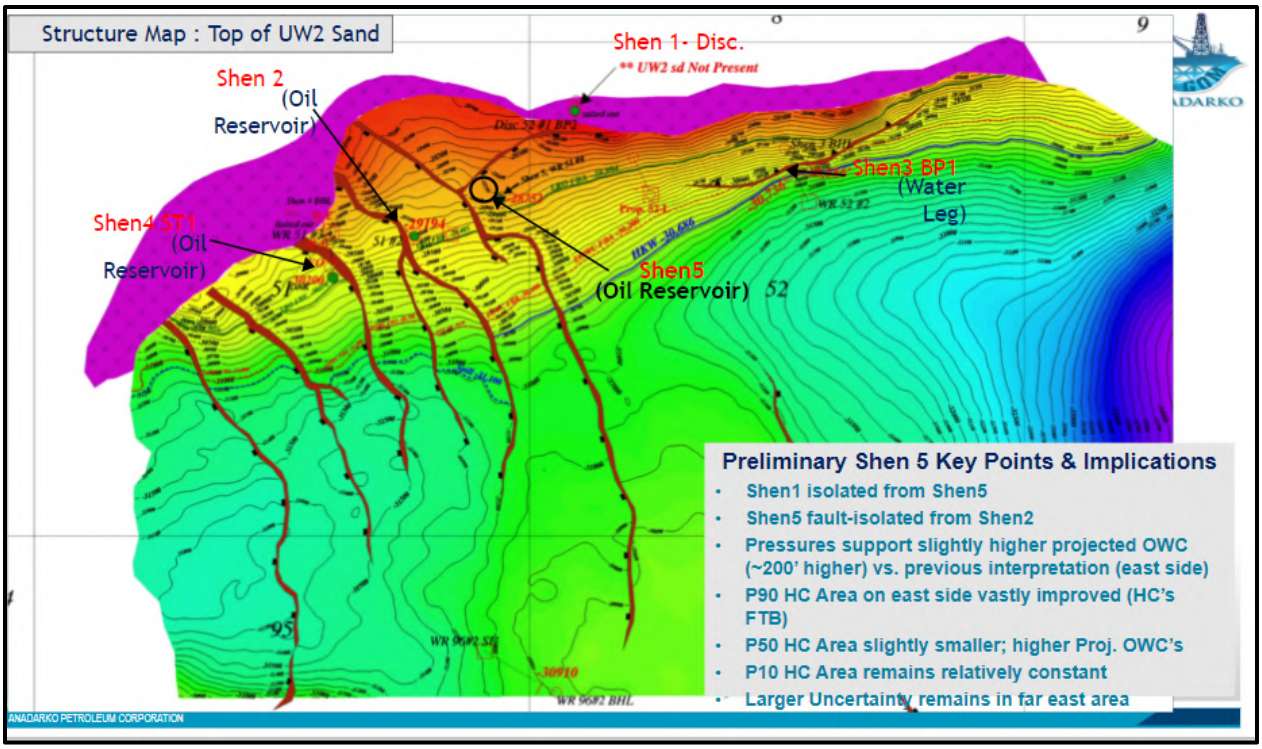

Exhibit 36: Shen-5 Results (6/17/16)

155. Pressure gradients in Shen-5 displayed in Exhibit 37 show more vertical compartmentalization than previously observed in earlier wells, with ten isolated compartments in this well alone. The attached figure shows that pressure in the UW2 Upper sand follows a lower pressure gradient trend than in the UW2 Lower sand.[135] The pressures in the UW3 Upper sand follow a lower trend than in the UW3 Middle sand, which follow a lower trend than in the UW3 Lower sand. This intra-sand vertical isolation adds to the fault complexity added by each well, resulting in even smaller compartments. The thinner the flow unit, the easier it can be isolated stratigraphically or by faulting, thereby increasing the likelihood of compartmentalization.

[135] APC-00077424 dated 6/27/16, page 13.

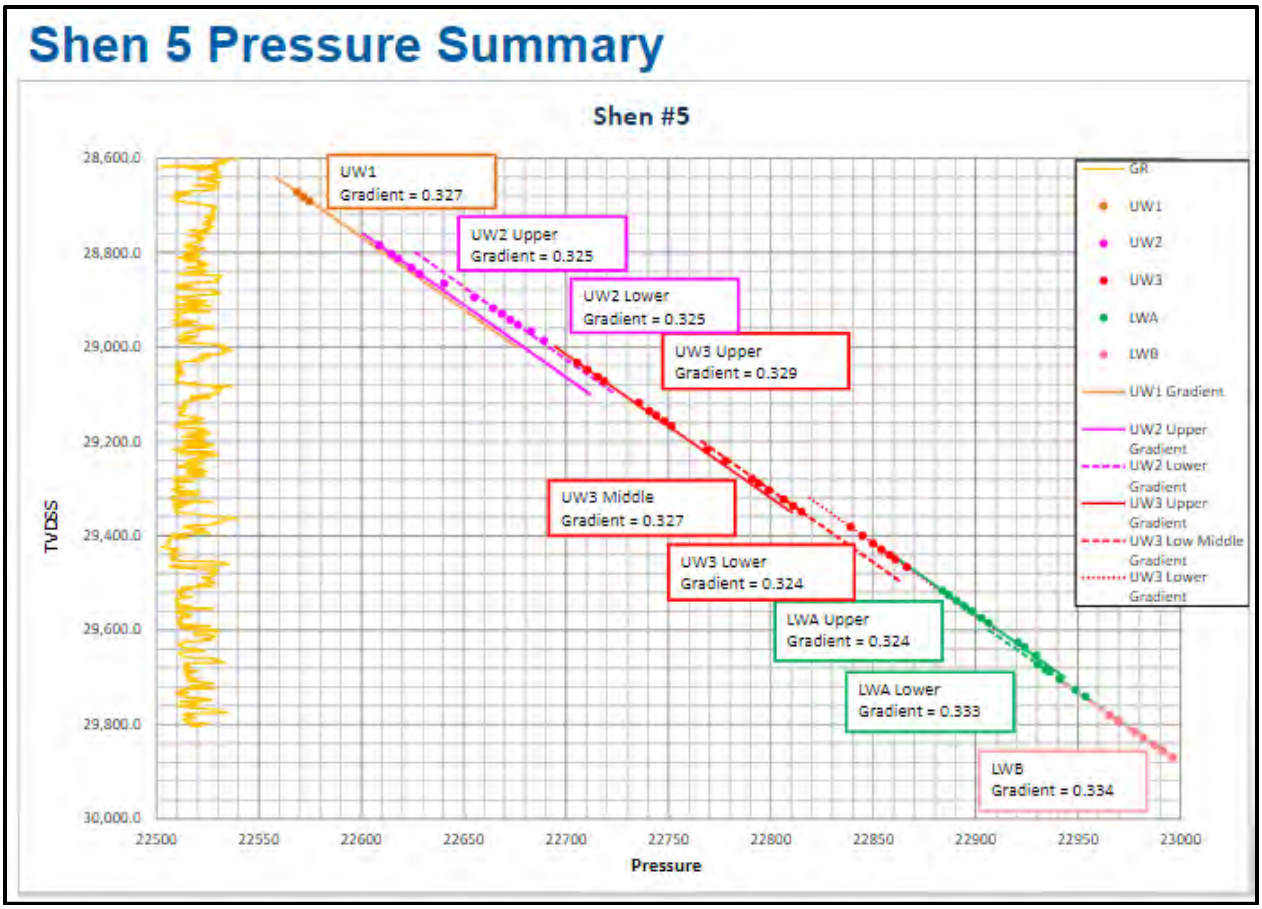

Exhibit 37: Shen-5 Pressure Profile from MDT Survey

156. Tar was reported in two intervals of Shen-5 in the LWC sand totaling 22 ft. in thickness in an email[136] dated July 2, 2016. Chandler wrote to his coworkers on the Development team, "*Well Shenandoah always seems to have its surprises, and this well is no exception.*" Complex faulting and compartmentalization can lead to more significant variation in reservoir fluid properties and formation pressures.

157. Exhibit 38[137] from a partner presentation dated September 28, 2016 also showed heavier oil in the Lower Wilcox sands with depth, ranging from 29.3 API in the LWA sand down to 23.7 to 27.5 API in the LWC through E sands. GOR values were also lower in the LWC through LWE sands ranging from 690 to 780 scf/bbl. These lower gravity, lower GOR oils would likely have a substantially lower recovery factor, as demonstrated in a simulation run[138] by Shotts showing recovery efficiency dropped from the base case of 26% to 18% for 28 API oil, resulting in 31% lower oil recovery for the heavier, thicker oil. Therefore, it may not have been cost-effective to develop and might have needed to be excluded from the effective pay count and resource volume.

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136 APC-00699952 dated 7/2/16.

137 APC-00278440 dated 9/28/16, page 19.

138 APC-00137267 dated 8/19/14, page 55.

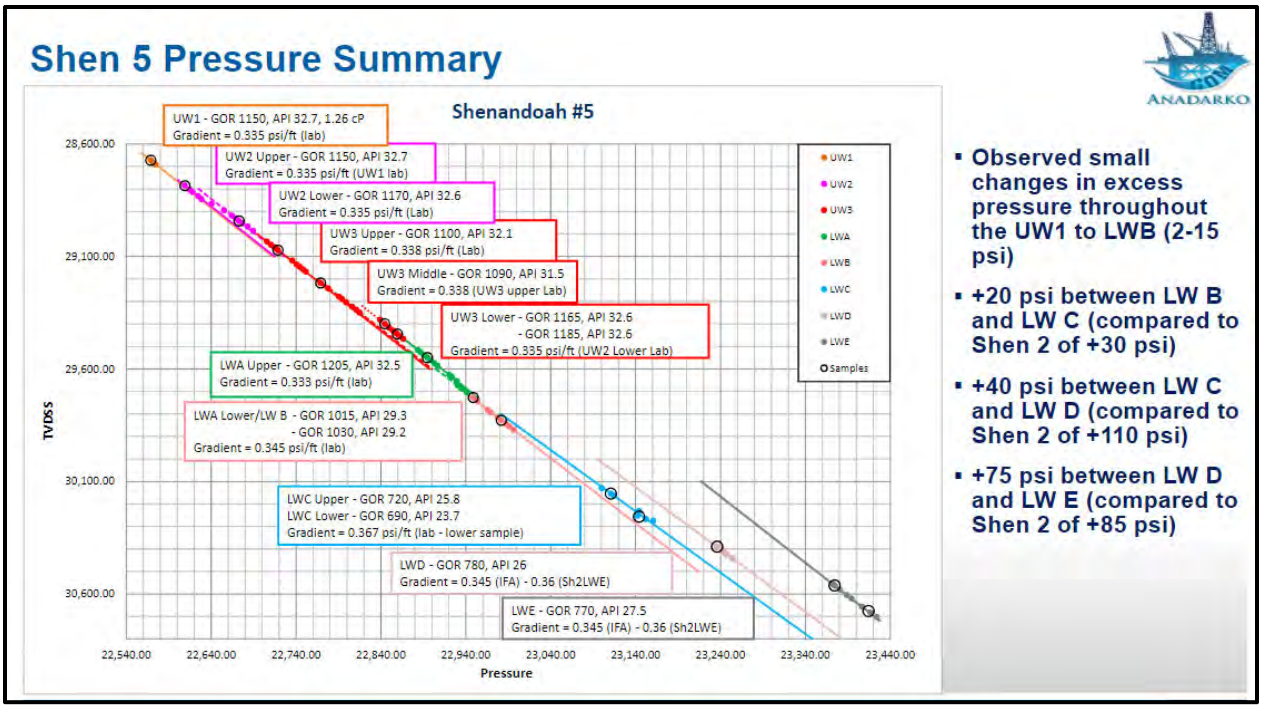

Exhibit 38: Shen-5 Pressure Plot with Fluid Properties (9/18/16)

158. Fluid properties varied even between the LWA Upper and LWA Lower sands, indicating intra-zonal compartmentalization. The pervasive presence of fault barriers within the reservoir is the most probable explanation for such wide variations in oil properties, allowing each fault block to have its unique history of oil migration, trapping, and sealing. In addition, tar sands interspersed within the LWC sand raises the risk of intraformational flow barriers caused by highly unpredictable tar accumulations.

H. Shen-6 Results

159. Shen-6 was wet, found no hydrocarbons, and revealed further faulting and associated complexities.

160. The Shen-6 well was drilled starting in November 2016 northeast of Shen-5 to determine the depth of the OWC and extend the known oil accumulation eastward. Chandler emailed[139] the Development team on February 5, 2017 announcing that the UW2 and UW3 sands were wet as follows:

> *"I've attached a cross section updated to 3 PM Sunday. As you can see the UW2 appears to be wet as does the upper portion of the UW3. This was the one scenario we feared the most. I don't have any good recommendations at this time other than to keep drilling to confirm the deeper sands are indeed all wet."*

[139] APC-00361054 dated 2/5/17.

161. A partner meeting was held to discuss the results and sidetrack options. A summary slide[140] states the well is wet in all sands and isolated from Shen-5: *"All the sands found are water-bearing"* and *"Confirmed presence of faulting between Shenandoah #5 and Shenandoah #6."* The following seismic section[141] in Exhibit 39 shows the extraordinary evolution of recognizing the presence of faults (black lines) since the August 18, 2014 mandate that no faults were to be mapped.

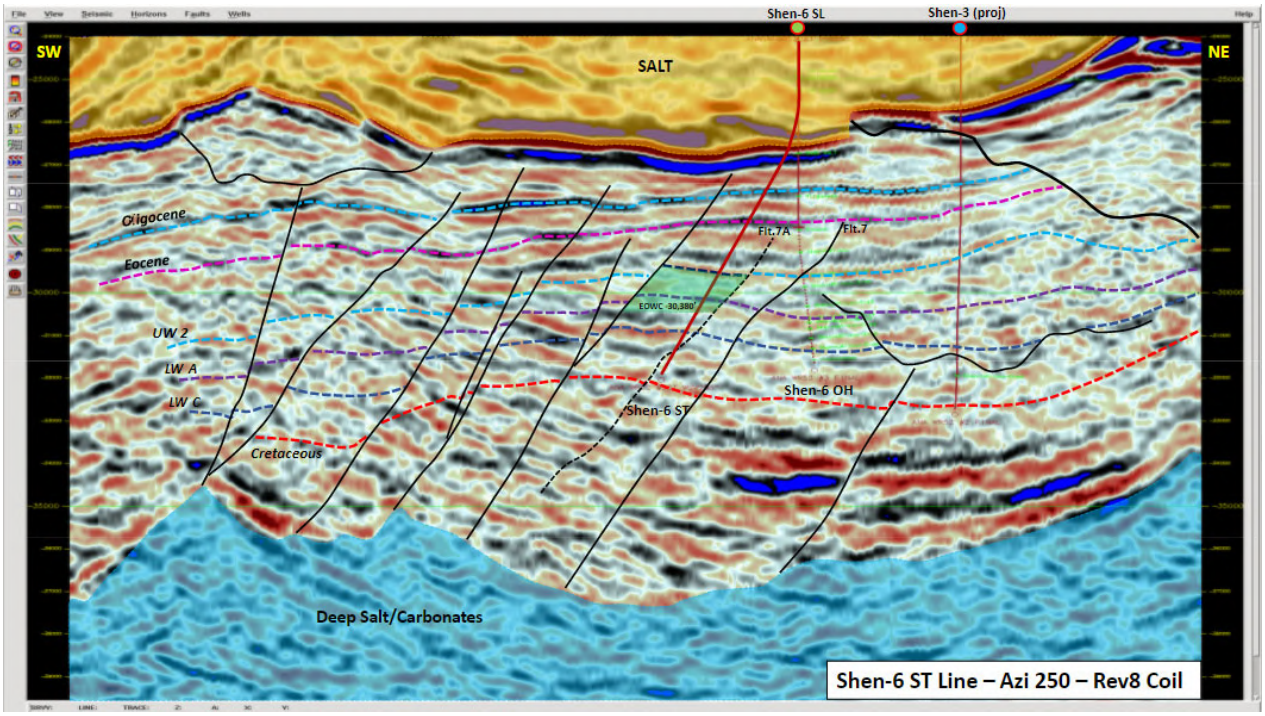

Exhibit 39: Complexity of Faulting Where Wells Have Been Drilled (2/15/17)

162. Twelve days after the well was reported as wet internally, Anadarko submitted its 2016 10-K form on February 17, 2017. The statement announces at page 11: "***The Shenandoah-6 appraisal well was spud in the fourth quarter of 2016. The drilling objective is to establish the oil-water contact on the eastern flank of the field and to help quantify the resource potential of the basin***." At the time of this submission, Anadarko unambiguously knew the well was wet, which severely negatively impacted the economic viability of the entire Shen project.

163. An accounting document[142] dated March 27, 2017 provides a summary shown below of two sidetrack attempts. The first sidetrack tested a location thought to be down-dip but in the same fault block as Shen-5. Finding the UW2 wet and in a separate pressure compartment as Shen-5 was a significant adverse finding, proving fault complexity on a very small scale that was not detectable within the resolution of the seismic data.

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140 APC-01264362 dated 2/15/17, page 4.

141 Same, page 11.

142 APC-00309656 dated 4/10/17, page 3.

"WR 52 #3 ST01 – On 02.19.17, the well was subsequently sidetracked out of the 14" casing at a depth of 25,488' MD with a westerly heading to test the oil-water contact limits in the Shen 5 fault block. Subsequent drilling operations to reach the Wilcox were problematic due to excessive fluid losses encountered at a depth of approximately 30,671' MD. Although the well did reach was was (sic) interpreted as the UW2 sand (wet), attempts to control the fluid losses were unsuccessful and the decision was made on 03.02.17 to set openhole plugs and abandon the openhole section.

WR 52#3 ST01 BP 01 – On 03.08.17, bypass drilling operations commenced in the open hole section at a depth of 29,300' md to make a second attempt to encounter oil-water contacts within the Shen 5 fault block. Drilled to a depth of 30,109' and set 11-7/8" casing on 03.13.17. Continued to drill and reached a depth of 30891' on 03.20.17 where excessive fluid losses and tar were encountered."

164. A presentation dated March 1, 2017 on Shen development options[143] concluded: "*Spar relocation is currently the only commercially viable solution for Shenandoah.*" The SPAR available for relocation was the Heidelberg SPAR, which was underperforming at the time. Such a serious conclusion regarding the only viable solution demonstrates the importance of the negative results from the Shen-6 well.

165. On April 26, 2017, Leyendecker emailed[144] a draft announcement that Anadarko would suspend appraisal activities on the Shen field.

166. In my expert opinion, the Shen appraisal project failed due to complex fault compartmentalization and Anadarko Exploration avoided and censored reasonable discussion of faulting and its impact.

VI. APPRAISING THE SHENANDOAH RESOURCE – RESOURCE SIZE, QUALITY AND ECONOMICS

167. A primary objective of appraising a deep-water discovery is to reduce the uncertainty in the size and quality of the resource so that decisions such as whether to proceed or exit and how to develop the field can be made with a reasonable level of confidence. Appraising a discovery is very much a "value of information" exercise. The cost of new information, mostly drilling wells, needs to be weighed against the impact on the value derived from that information.

168. A simplified approach to assessing the value of information is estimating the probability that the new information will affect or change decisions multiplied by the value added by those changes. Risks and uncertainties abound when the reservoir is almost six miles below the surface, reservoir pressures approaches 24,000 psig, water is over one mile deep, development wells are expected to cost more than $200-$310 MM to drill and complete, and total capital

[143] APC-00090245 dated 3/1/17, page 10.

[144] APC-00073642 dated 4/26/17.

investment might exceed $10 billion. The quality of the reservoir becomes especially important in a high-cost setting in which wells cost several hundred million dollars

169. When appraising a discovery, the recoverable resource volume is a key metric, which is the product of area in acres, net pay in ft. and recovery in bbl/acre-ft. The areal extent of an oil accumulation is a function of the trappable area within a mapped closure and how much of that area is filled with hydrocarbons, which is defined by the OWC or fault boundary. Net pay in feet (ft.) is the vertical thickness of hydrocarbon-filled sands that meets porosity, hydrocarbon saturation and clay cutoff thresholds, as measured by well logs. Recovery is the product of 7,758 bbl/acre-ft. times porosity (%), oil saturation (%), recovery factor (%), and divided formation volume factor (reservoir/surface standard conditions).

170. Each parameter is most commonly described using a log-normal probability distribution to quantify the uncertainty in the potential range of outcomes. The fractiles P1, P10, P50, P90, and P99 quantify the percent chance of exceeding a certain value for a range of uncertain outcomes. For example, the P1 value represents an absolute maximum with only 1% of outcomes being larger. The P10 value represents the upside case with 1 in 10 outcomes being larger. The P50 value is larger than half of the outcomes, and smaller than the other half. The P90 value is a downside result exceeded by 9 out of 10 outcomes. Finally, the P99 value is the absolute downside case with little chance of being smaller. The most commonly used resource range in the industry is P10-P90.

171. The assessment of resource size is a key factor in deciding whether to sanction the development of a discovery, especially when facilities costs have a high fixed-cost component with larger fields benefitting from economy of scale. When burdened with a high fixed cost, smaller fields bear a higher per-barrel cost; larger fields have a smaller burden from fixed costs. Minimum Commercial Field Size (“MCFS”) is a useful concept to help understand the importance of field resource size, especially what percentage of the resource range falls above and below the MCFS.

172. The MCFS can be determined by modeling cash flows of development scenarios of varying resource volumes. The MCFS is the field size with breakeven economics: smaller sizes have negative discounted net present values, with larger sizes providing positive values due to the economy of scale. Typically, the MCFS is calculated for different oil prices, because the price can be the significant uncertainty driving value.

173. When well costs are high and lateral continuity uncertain, estimated ultimate recovery per well (“EUR/well”) can also be an important uncertainty impacting the MCFS. The EUR/well is primarily impacted by net pay per completion, effective drainage area per well, and recovery efficiency. Both effective drainage area per well and recovery efficiency are adversely impacted by reservoir compartmentalization caused by faulting and stratigraphic changes.

174. PIR10 is an important concept for understanding Shen’s commerciality. PIR10 stands for Profit to Investment Ratio discounted at 10%. The term is widely used in the petroleum industry as an economic measure of capital efficiency. The numerator is the net present value of estimated cash flows discounted at 10% and the denominator is the net capital invested, also discounted at 10%. The measure is useful for ranking the capital performance of a portfolio of

investment opportunities. A threshold PIR10 represents the minimum value required for an investment to be approved to receive capital funding in the budgeting process. In Hollek's deposition on 9/8/22, he testified that Anadarko's threshold PIR10 was 0.30.[145]

> *Q. And was a PIR 10 of .30 generally a threshold for Anadarko to consider a prospect commercial?*
>
> *A. I don't remember exactly, that -- but that may have been a minimum threshold.*
>
> *Q. And would that have been set forth in any policies?*
>
> *A. I wouldn't say a policy; maybe a general guideline.*
>
> *Q. Do you recall what the document was called?*
>
> *A. No, I don't.*
>
> *Q. But in practice, you recall that .3 was generally considered the threshold?*
>
> *A. I believe that was sort of a hurdle rate.*
>
> *THE COURT REPORTER: A what rate; hurdle rate?*
>
> *THE WITNESS: Yes. Basically an economic threshold to be even considered.*
>
> *BY MS. JENSEN:*
>
> *Q. Right below which it would not be deemed commercial?*
>
> *A. Based on what you know at the time.*

175. PIR10 at .3 was thus an important metric for determining whether Shen was economically viable by Anadarko's own standards and practice. This meant that if the PIR10 dropped below .3, Shen would not likely receive funding.

A. Pre Shen-2: Exploration Team

176. Shen-1, the Shenandoah Discovery well, was drilled and evaluated from June 2008 through January 2010. Exhibit 40 below from a 2009 presentation[146] shows the well encountered approximately 300 ft. of oil-bearing pay. Individual pay counts by zone are also shown on the slide, but they only total 295 ft. of pay. The well was eventually reported[147] to have 236 ft. of net pay TVT, which is substantially less than initially claimed.

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[145] Darrell Hollek Deposition dated 9/1/22, page 53, line 6 to page 54, line 8.

[146] APC-01669740 dated 4/8/09, page 2.

[147] APC-01678818 dated 1/19/15, pages 7-8.

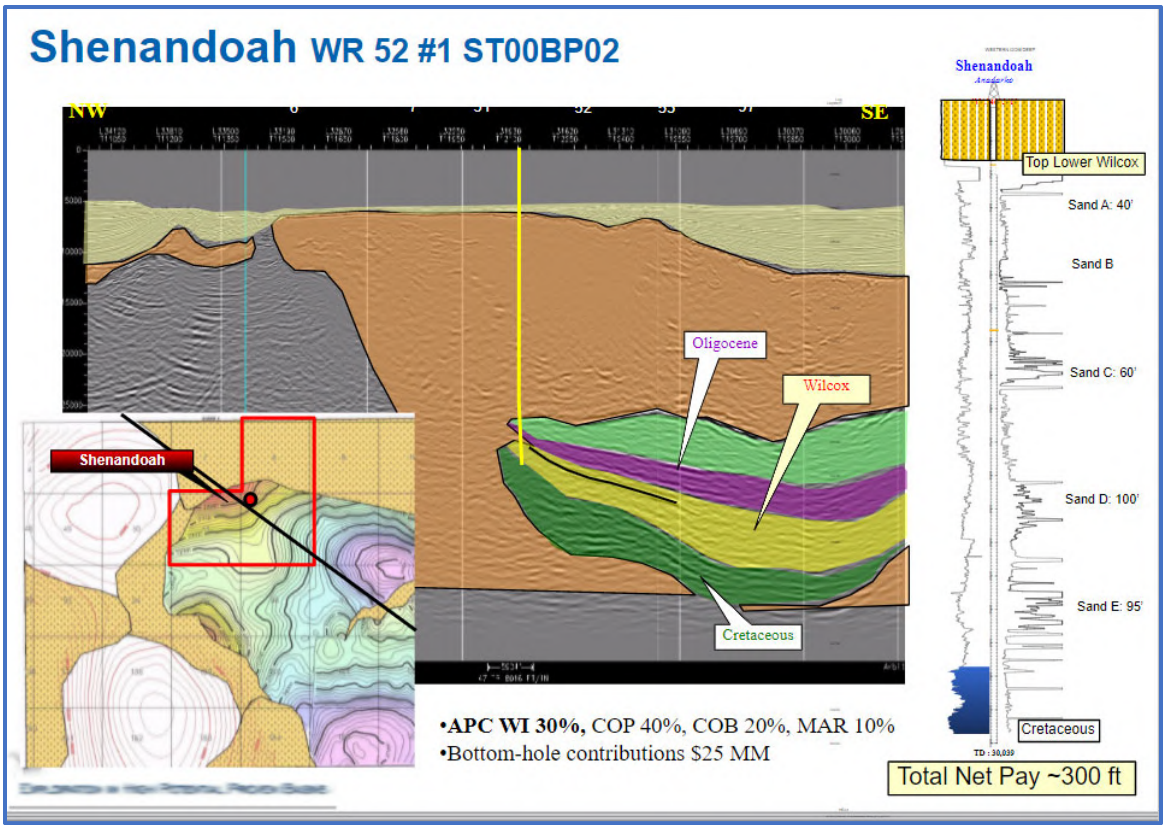

Exhibit 40: Crestal Thinning and Down-dip Thickening

177. Exhibit 40 shows a northwest-southeast seismic cross-section in which the Wilcox unit thins as it rises to the crest of the structure to the northwest. The following slide[148] (Exhibit 41) in this presentation shows that thinning to the crest and conversely thickening down-dip were explicitly recognized, both before and after Shen-1 was drilled. The recognition of probable thinning toward the crest of the structure is an important issue discussed later in assessing the recoverable resource volume, especially in the November 2014 resource evaluation. A partner presentation[149] dated November 2, 2010 containing Exhibit 41 also showed the same observations about crestal thinning and approximately 300 ft. of pay for Shen-1.

[148] Same, page 3.

[149] APC-01669805, pages 25 (for 300 ft., 26 for thickening down-dip), and 45 (for the 260 ft. of pay total).

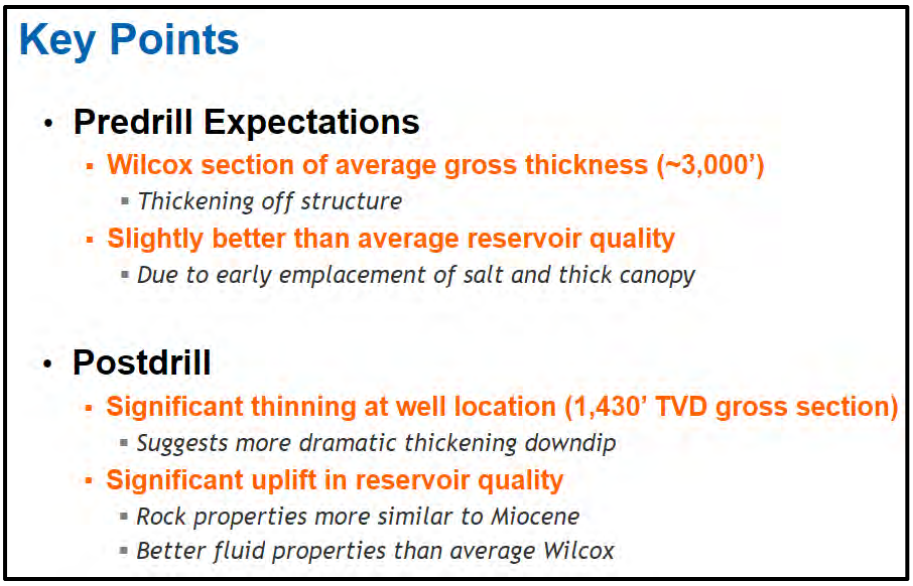

Exhibit 41: Pre and Post Shen-1 Knowledge of Thickening Off Structure (11/2/10)

B. Pre-Shen-3: Exploration Team

178. In early June 2013, Exploration's resource assessment was updated to include results from both Shen-2 and Yucatan-2 southwest of Shen. Before the Yucatan well, their mean resource estimate for the Shen area was 1,179 MMBOE, and following the well, their estimate for the mean was raised slightly to 1,197 MMBOE.[150] This resource estimate was dominant from mid-2013 until late 2014 based on its inclusion in several presentations by the Exploration group and other documents during this period, such as Exhibit 46.

179. The Exploration group calculated the estimated resource range using software by Rose and Associates, including the Multi-Method Risk Analysis ("MMRA") program and the Multi-Zone Master, both Excel-based software. The MMRA tool calculates a range of resource sizes based on assumptions for the area, net pay, and recovery that are input as probabilistic ranges and combined using the process of Monte Carlo simulation. The Multi-Zone Master can then be used to combine different layers or fault blocks. With multiple stacked sands and fault blocks, no single method has been deemed correct or the industry standard in classifying the parts and combining those parts, allowing various approaches to calculate resource volume.

180. The method used by Exploration calculated the resource distribution first by stratigraphic layer using MMRA and then combined the UW1 and UW2 sands (treated as one unit) with UW3 in one Multi-Zone Master file and combined the LWA, LWB, LWC, LWD, and LWE sands in another Multi-Zone Master file. Next, the UW result was combined with the LW result in another layer of adding distributions for the main block. Finally, a small volume north of the fault was added to the main block to arrive at the field total. This method of combining multiple layers is detailed in Appendix B, showing Bates numbers for files involved.

[150] APC-01676575 dated 4/2/14, in sheet "MMRA."

181. Exploration's resource distribution ranged from 830 MMBOE for P99; 952 MMBOE for P90; 1,173 MMBOE for P50 (median); 1,197 MMBOE for the mean; 1,469 MMBOE for P10; and 1,700 MMBOE for P1. Standard industry practice considers the P99 value as representative of an absolute minimum, so Exploration represented the Shen discovery after Shen-2 as having a 99% chance of being the second-largest field in the deep-water GOM based on Exhibit 42[151] below. The P10/P90 ratio of only 1.54 is too low for a discovery delineated by only two wells.[152] In my expert opinion, the lower end of this distribution did not represent the uncertainty existing at that time, especially considering the poor-quality seismic imaging below the salt.

Top 10 Deepwater GOM Fields

	Field	EUR (MMBOE)
1	Mars	1,133
2	Ursa	399
3	Tahiti	303
4	Auger	271
5	Mad Dog	202
6	Genesis	238
7	Ariel	204
8	Shenzi	180
9	Petronius	198
10	Troika	216

Exhibit 42: EUR of Deepwater Fields in the Gulf of Mexico

182. One source of inaccuracy in Exploration's resource range resulting in a large value for P90 is the method of adding several elements together with the assumption of independence between each sampling event. For example, the combined estimate for the Lower Wilcox sands was the sum of five layers A through E being sampled with complete independence from each other. The average resource P10/P90 ratio for each Lower Wilcox sand was 3.6, but the resulting Multi-Zone Master resource range for five zones had a P10/P90 ratio of only 1.84 based on independence between each horizon. Summing independent sampling events results in a substantial reduction in variance depending on the number of sampling events. In contrast, the sum of fully dependent events tends to preserve the variance. Consequently, the summation process combining elements shown in Appendix B involved 11 total events, all sampled with the assumption of complete independence, causing the P10/P90 ratio to flatten significantly and understate the downside risk.

183. One argument for assuming dependence and not independence between outcomes for each horizon is when multiple layers in a stacked reservoir share a common uncertainty. An example is with depth conversion errors caused by thick overlying salt layers that would impact how multiple layers were mapped and not just one layer independently. This issue is especially

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[151] APC-01702251 dated 1/21/16, page 32.

[152] This is discussed in Dr. Merrill's report at paragraphs 27-29.

relevant to Shen. Another factor affecting Shen is that faulting affects multiple horizons. With some degree of dependence assumed in the combination process, the variance represented by the the resource range (*i.e.*, P10/P90 ratio) will not decrease as much as when independence is assumed, preserving more of the downside uncertainty in the P90 result.

184. Shen-1 was missing the entire Upper Wilcox sands, probably resulting from a single factor – faulting - affecting all three layers.

185. The P10, P50, and P90 assumptions for the area, net pay, and recovery factor for each horizon are shown in Exhibit 43[153] that match the files provided in Appendix B.

[153] APC-00115013 dated 2/26/14.

Shenandoah								
Deterministic Calculations of STOOIP from MMRA input values								
P90	Zone	UW1+2	UW3	LW A	LW B	LW C	LW D	LW E
Area	Acres	2545	2885	3520	3260	3260	3115	3260
Net H	ft	100	165	136	118	141	20	80
Porosity	frac	0.1796	0.1796	0.1796	0.1796	0.1695	0.1298	0.159
So	frac	0.597	0.597	0.597	0.597	0.725	0.698	0.701
Bo	RB/STB	1.3	1.3	1.3	1.3	1.3	1.4	1.101
STOOIP	MMBO	163	305	306	246	337	31	205
P50	Zone	UW1+2	UW3	LW A	LW B	LW C	LW D	LW E
Area	Acres	3908	4161	5121	4928	4928	4817	4928
Net H	ft	117	184	155	134	151	44	91
Porosity	frac	0.2075	0.2075	0.2075	0.2075	0.1976	0.1612	0.1872
So	frac	0.726	0.726	0.726	0.726	0.725	0.778	0.779
Bo	RB/STB	1.397	1.397	1.446	1.446	1.446	1.545	1.1978
STOOIP	MMBO	383	641	642	534	572	133	424
P10	Zone	UW1+2	UW3	LW A	LW B	LW C	LW D	LW E
Area	Acres	6000	6000	7450	7450	7450	7450	7450
Net H	ft	137	205	176	152	161	95	105
Porosity	frac	0.235	0.235	0.235	0.235	0.2247	0.1933	0.2149
So	frac	0.825	0.825	0.825	0.825	0.786	0.837	0.837
Bo	RB/STB	1.496	1.496	1.594	1.594	1.593	1.693	1.2954
STOOIP	MMBO	826	1237	1237	1069	1032	525	843

Exhibit 43: Assumptions Used in 6/13 Resource Assessment of Shenandoah Field

186. The assumed areas are based on structure maps for P10 and P90 areal extent in a presentation titled "SHENANDOAH Exploration – Development September 2013."[154] The structure map for the Shenandoah LWA sand is shown as an example in Exhibit 44 below. The extent of the P10 area extends to the spill point shared with the Yucatan discovery. In my expert opinion, this area would be more representative of a P1 maximum than a P10 scenario, making the P10 area overly optimistic. The P90 area shared the same northern boundary as the P10 case and extended almost as far east and west as the P10 area. In my expert opinion, the assumption of no downside risk in the oil accumulation's northern, eastern, and western boundaries does not follow

[154] APC-00592977 dated 11/14/13.

standard industry practice: the range of possible downside outcomes was not captured in this highly optimistic version of a P90 scenario. The same line of reasoning holds for all seven horizons mapped.

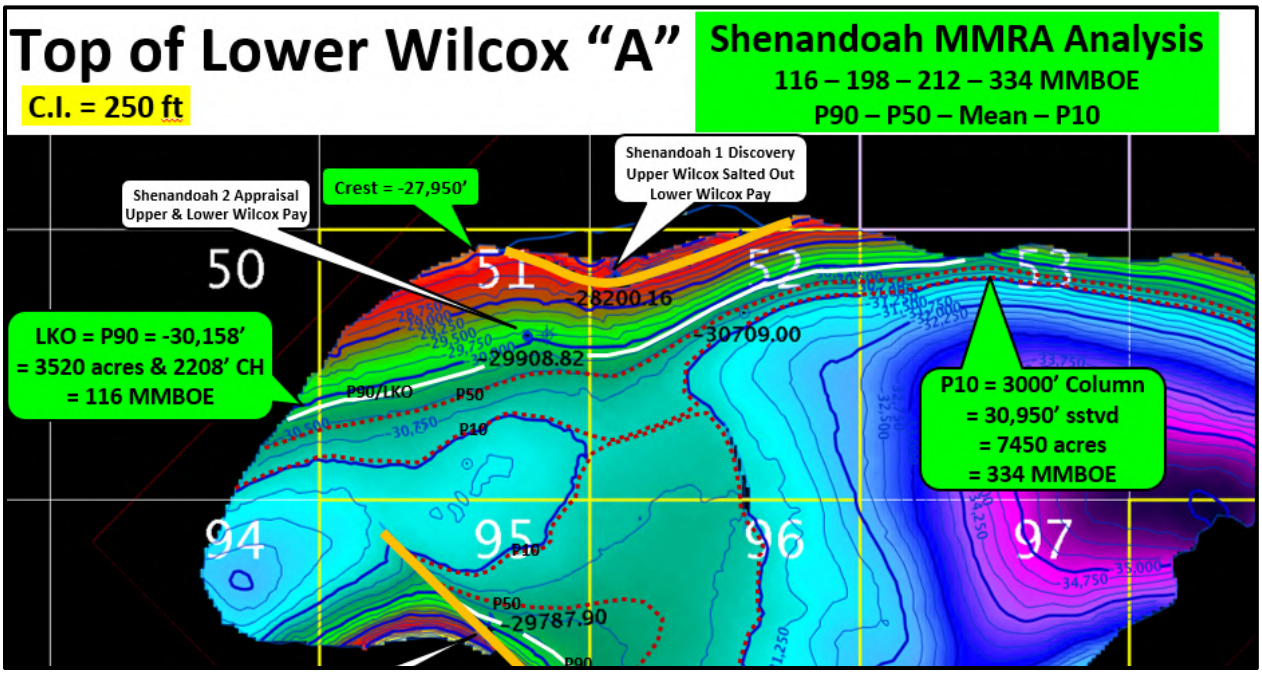


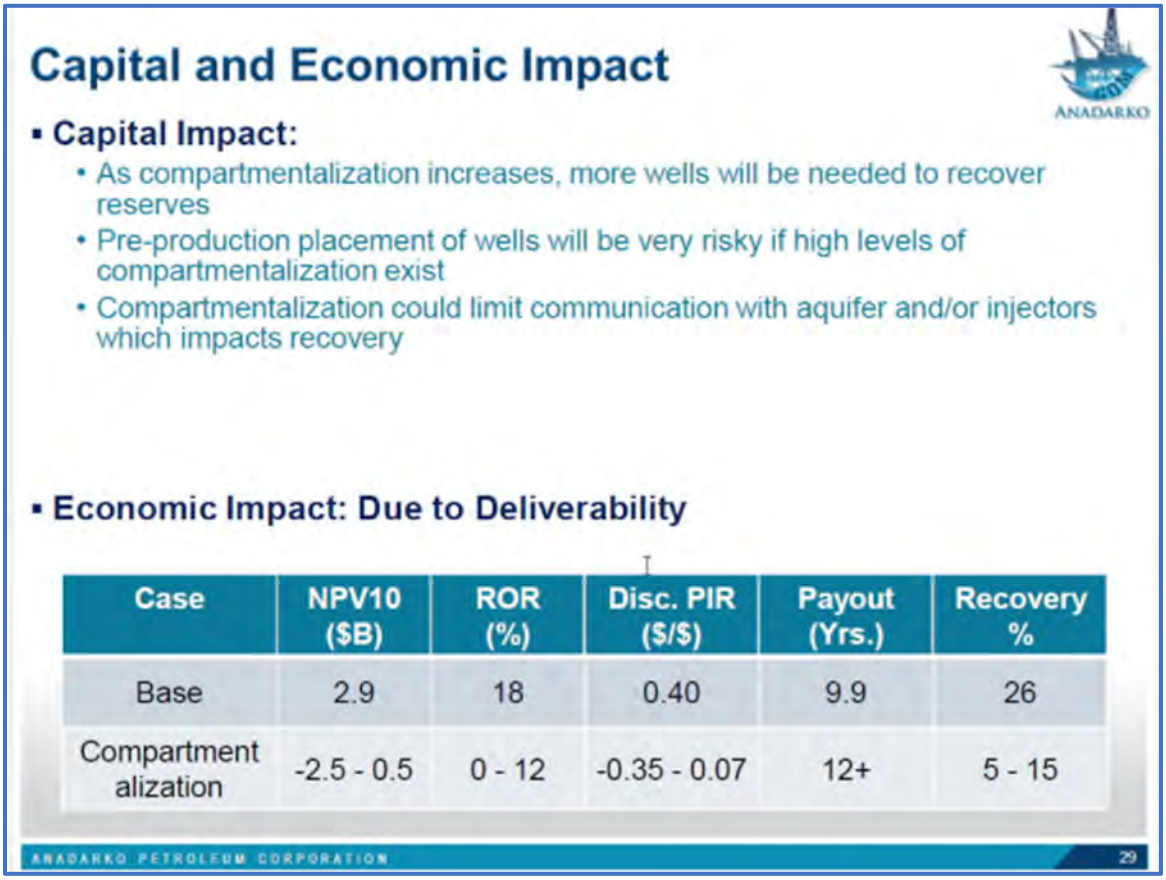
Exhibit 44: Example of Structural Map for Basis of Area Estimates (11/14/13)

187. The sum of P90 net pay for all eight sands combined totaled 760 ft. and was more than twice the net pay thickness encountered in Shen-1; the sum of P10 net pay for all zones totaled 1,031 ft., which exceeded the total encountered in Shen-2. In my expert opinion, these P10 and P90 net pay estimates are very optimistic. The estimates do not honor the data given: (1) the P90 assumption for net pay was more than twice the lower result in Shen-1 results; and (2) the P10 estimate exceeded the best Shen-2 result to date. Most of the oil-filled structure lies up-dip of Shen-2, and to having a fieldwide net pay value greater than Shen-2 requires thickening higher in the structure, which is precisely opposite to the existing evidence for crestal thinning discussed above.

188. Another source of inaccuracy in Exploration's resource estimate regarded the appropriate recovery factor: the percentage of oil initially in place that can be expected to be recovered with the assumed development plan. The Exploration team assumed recovery factors ranging from 20%-30% (P90-P10) for the LWD and LWE sands, with a mean of 24.8%, and for all shallower sands, the assumed range was 20%-35%, with a mean of 27.1%. By contrast, Marathon's mean recovery factor was calculated at 17.8% in their study.[155] The P90 recovery factor was 21.8%, and the P10 was 14.2%. Exploration's assumption for a mean recovery factor of 27.1% compared to Marathon's finding of 17.8% resulted in a 52% (27.1%/17.8%) higher recoverable volume for the same oil in place. This was decidedly over-optimistic.

[155] APC-00005056 dated 4/3/14, page 8.

189. As discussed above, Shotts' August 19, 2014, reservoir modeling study[156] highlighted the potential negative impact of faulting on recovery efficiency considering the high asphaltene onset pressures. With just north-south sealing faults, the recovery factor dropped to 15%, down from 26% for an unfaulted, laterally continuous model. Introducing a moderate number of east-west faults caused the recovery factor to drop down to just 5%. In my expert opinion, the following slide[157] was one of the most important slides produced by Anadarko regarding the Shen discovery. With increased compartmentalization, more wells are needed, placement of these wells more difficult, and aquifer support less likely, requiring optimally placed injection wells in each fault block to prevent asphaltene dropout. The study also provided an economic warning to the organization that compartmentalization could result in unfavorable project economics as shown in Exhibit 45.



Case	NPV10 ($B)	ROR (%)	Disc. PIR ($/$)	Payout (Yrs.)	Recovery %
Base	2.9	18	0.40	9.9	26
Compartmentalization	-2.5 - 0.5	0 - 12	-0.35 - 0.07	12+	5 - 15

Exhibit 45 Early Warning of Compartmentalization Impact on Project Economics (Shotts 8/19/14)

190. Kleckner demonstrated the importance he placed on the resource and economic analyses performed by the Development team, labelling their work as "*our current views*" and

[156] APC-00137267 dated 8/19/14, pages 26-28.

[157] APC-00348720 dated 8/27/14, pages 66-67.

wanting to understand the contrasts with Exploration economic analysis. The email[158] from Kleckner to Hollek and O'Brien is quoted as follows:

> *"Are you both available early this afternoon to walk through GOM strategy slides specifically related to DW rig schedules. Would also like a quick update on Shenandoah economics to understand our current views related to 20k initiatives and how this contrasts with explorations economic model."*

C. Pre-Shen-3: Development Team

191. Lea Frye joined the Shen team as Development's Senior Reservoir Engineer in January 2014, and the Development team presented a comparison between the Exploration and Development team resource and economic evaluations to management on February 19, 2014.[159] The Exploration team showed a P50 Case of 949 MMBO and a rate of return of 34%. The Development team showed a deterministic case of 767.5 MMBO, resulting in a 19% rate of return. Exploration's 949 MMBO P50 case (25% recovery factor and 1,000 scf/bbl GOR) was similar to their 1,197 MMBOE discussed earlier when adjusted for the gas equivalence and slightly different recovery factor assumed in the MMRA files. The Development team's resource estimate was smaller primarily due to a lower assumed recovery factor of 20%, compared to Exploration's 25%. The Development team's 19% rate of return was lower due to the 19% lower recoverable resource volume and higher facilities cost of $6.3 billion compared to Exploration's cost of $3.4 billion. Total development drilling and completion costs were similar for the two groups.

192. The day before this presentation, Blakely and Strickling, both in Exploration, wrote in an email[160] exchange about Frye's economic evaluation of the Shen project that she would be showing to Kleckner. They expressed concern about her results: "*Lea is coming up with economics with a PIR of <4 for Shenandoah.*" Blakely then responds with the following: "*Ok.* ***We need to keep from delivering a message to Kleckner that Shenandoah is a marginal project by being overly conservative on assumptions***." *(emphasis added).* This exchange establishes that Exploration was concerned about having Development express independent and potentially more conservative project analyses.

> Blakely to Strickling (2/18/14 12:04 PM: *"I saw Pat in the partner meeting. He said that Lea is coming up with economics with a PIR of <.4 for Shenandoah. Has she shared her assumptions with you?"*
>
> Strickling to Blakely (2/18/14 12:11 PM: *"Not yet. She is supposed to come up after the partner meeting."*

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158 APC-00614945 dated 9/29/14.

159 APC-01674681 dated 2/18/14, pages 5, 6, 10 and 11.

160 APC-00603676 dated 2/18/14.

Blakely to Strickling (2/18/14 12:17 PM: *"Ok. We need to keep from delivering a message to Kleckner that Shenandoah is a marginal project by being overly conservative on assumptions. See if you can help her out."*

Strickling to Blakely (2/18/14 8:59 PM: *"Review the economic assumptions with Lea:*

Recovery factor is 20% instead of our 25% even though water injection is assumed.

Platforms cost twice as much as Frank's sheet estimates.

Wells are constrained by drawdown limits.

Overall there are fewer wells since re-completions are assumed. However, no learning curve is applied to drilling costs so their total cost for drilling is about the same as ours.

LOE is twice what we are using.

Downtime for wells and facilities is accounted for by reducing the overall production profile not a schedule.

So it is pretty much what we expected. Lea had made slides with our economics and assumptions but I said she probably didn't want to present those to prevent disagreements over assumptions."

193. On February 19, 2014, Frye presented Shen economics to a senior management team, including Hollek and Leyendecker. In response to her economic analysis, Frye reported[161] that Leyendecker directed the following derisive statement to her:

"You do not know anything."

194. This derisive comment was corroborated by Blakeley's testimony[162] on August 19, 2022:

"Q. But he did tell her, "You don't know anything"; correct?

A. I believe that's – those were the words he used, yes."

195. In my expert opinion, such a derisive comment by a senior manager to a professional with over a decade of experience presenting technical analysis was inexplicable. It was even more unwarranted given that the basis for her economic analysis was sound.

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[161] APC-00113302 dated 5/9/16, page 5.

[162] David Blakeley Deposition dated 8/19/22, page 90, lines 1-4.

196. The 767.5 MMBO deterministic estimates in Frye's February 14, 2014 presentation served as the Development team's resource volume for economic evaluations presented to Kleckner on February 24, 2014[163] and April 2, 2014,[164] and the Executive Committee on July 9, 2014[165] and September 29, 2014,[166] representing the Development team's stance for much of 2014 leading up to the Shen-3 appraisal well. An Excel worksheet dated February 17, 2014[167] provides the details for calculating a 767.5 MMBO recoverable resource volume

D. Post Shen-3: Exploration Team

197. Resource ranges and estimates dropped after Shen-3 for both Exploration and Development. Exploration noted a 47% decrease in mean area and 23% decrease in recoverable resources, yet also assumed a 32% increase in net pay.

198. On November 14, 2014, Blakely emailed the following: "*we finished up early this morning. All zones were water bearing.*" Just over one week later, Camden announced[168] his revised MMRA resource assessment incorporating the results from Shen-3 as follows:

> *"OK, I rolled up the new MZ for North and South of the fault with the latest numbers – and below is what we are looking at. I have not fully vetted all the Porosity and Sw distributions (clipping), but they should be pretty close.*
>
> *It's about a 25% drop on the mean – probably makes sense. So, you could say this was a disappointing well in that we fell below the contacts and the resources were lowered. . . . BUT, it's still a world class sized resource."*

199. The revised estimate had a mean of 917 MMBOE recoverable resource ranging from 781 MMBOE for P90 to 909 MMBOE for P50 to 1,059 MMBOE for P10. The resulting mean of 917 MMBOE was 23% lower than the pre-Shen-3 mean of 1,197 MMBOE. Exhibit 46 provides a comparison in the form of a bar chart.[169]

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[163] APC-00798192 dated 2/24/14, page 12.

[164] APC-00000670 dated 4/2/14, page 22.

[165] APC-00129874 dated 7/9/14, page 11.

[166] APC-00838406 dated 9/29/14, page 25.

[167] APC-00797929 dated 2/17/14, worksheet "Reserves_Well_500Acres," cell Q23 shows result of 767.5.

[168] APC-00617381 dated 11/22/14.

[169] APC-00617383 dated 11/22/14.

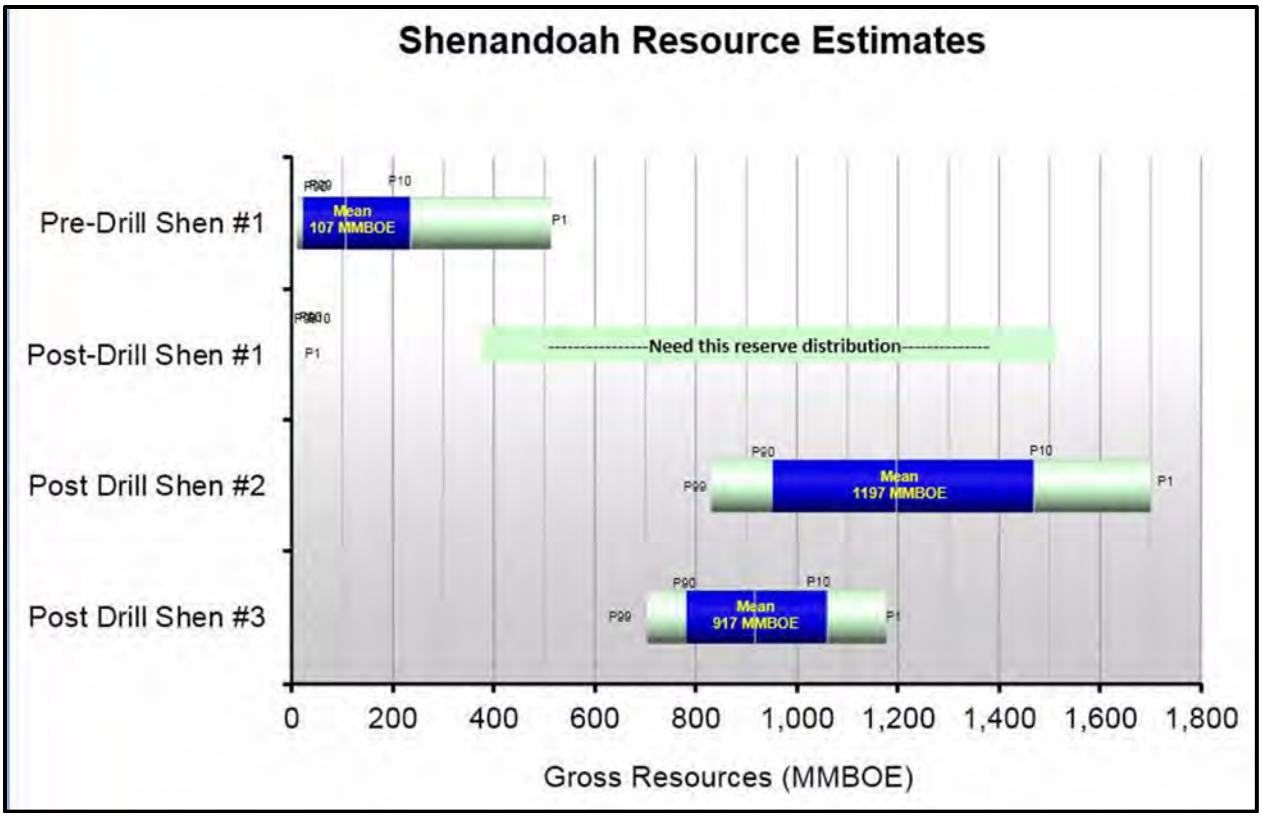

Exhibit 46: Impact of Shen-3 Resource Estimate

200. Exhibit 47 below compares key input assumptions in the June 2013 and November 2014 MMRA evaluations of the recoverable resource by each horizon, with the UW1 and UW2 combined in a single file. Typically, area and net pay have the most uncertainty, followed by the recovery factor. The column on the right shows a 47% decrease in the assumed mean area from June 2013 to November 2014 but a 32% increase in net pay, resulting in an approximate 23% decrease in the overall recoverable resource volume.

Zone	UWLX 1&2		UWLX 3		LWLX A		LWLX B		LWLX C		LWLX D		LWLX E			
	13-Jun	14-Nov	13-Jun	14-Nov	13-Jun	14-Nov	13-Jun	14-Nov	13-Jun	14-Nov	13-Jun	14-Nov	13-Jun	14-Nov	13-Jun	14-Nov
Area, acres															Average Area	
P90	2545	2110	2885	2402	3520	2235	3260	2135	3260	2250	3115	2215	3260	2160	3121	2215
mean	4127	2939	4330	2963	5339	2559	5184	2435	5184	2364	5096	2503	5184	2585	4921	2621
P10	6000	3875	6000	3570	7450	2900	7450	2750	7450	2480	7450	2805	7450	3040	7036	3060
Change in Mean		-29%		-32%		-52%		-53%		-54%		-51%		-50%		-47%
Net Pay, ft TVT															Total Net Pay	
P90	100	165	165	240	136	175	118	125	141	125	20	80	80	100	760	1010
mean	118	217	185	269	155	187	135	132	151	137	52	90	92	135	888	1168
P10	137	274	205	300	176	200	152	140	161	150	95	100	105	175	1031	1339
Change in Mean		84%		46%		20%		-2%		-9%		73%		47%		32%
Resources, MMBOE															Total Resources	
P90	65	99	117	143	116	87	94	59	106	61	16	37	67	61	582	547
mean	127	177	211	224	214	131	179	88	197	90	51	52	121	98	1100	859
P10	204	273	326	319	334	182	285	122	309	123	101	68	186	141	1744	1228
Change in Mean		39%		6%		-39%		-51%		-54%		1%		-19%		-22%
TVT Net*, ft																
Shen1 Net Pay					30		0		39		91		76		236	
Shen1 Net Sand					121		52		124		91		76		464	
Shen2 Net Pay	165		240		160		139		166		38		94		1002	
Shen 3 Net Sand*	214		350		267		149		60		203		227		1470	
Bates Number	*APC-00852359*		*APC-00852358*		*APC-00852357*		*APC-00852356*		*APC-00852355*		*APC-00852354*		*APC-00852353*			

** Bates APC-00021100 page 22.*
13-Jun data from Exhibit 44

Exhibit 47: Comparison of Assumption for 6/13 and 11/14 Evaluations

201. Two factors caused the 47% decrease in mean area. First, Shen-3 encountered wet sands inside most of the P10 boundary for most horizons, causing the P10 limits to be drawn more conservatively. Second, Shen-3 encountered the formation tops approximately 600 ft. deeper[170] than mapped before Shen-3 with depth already calibrated at the crest by Shen-1. By finding each horizon ~600 ft. deeper than expected, the northwest to southeast dip needed to be steepened substantially, thereby causing the structure to narrow, reducing the area for each horizon.

202. A small volume labeled north of the fault was not included in the table because the author could not identify any file representing the estimate for resources north of the fault isolating Shen-1.

203. The structure maps that provide the basis for these P90 and P10 area estimates are in APC-01678818, pages 28-34. The map for the UW2 horizon, Exhibit 48, shows the P10 contour (black dash, projected OWC) is very close to the highest known water encountered in Shen-3, extending roughly east-west across the entire 7.6-mile structure. In my expert experience, this contour would represent the maximum areal extent for a much rarer P1 upside case rather than the P10 case.

[170] Based on comparison of structure maps pre-Shen-3 (APC-00592977 dated 11/14/13, pages 36-42) to post-Shen-3 maps (APC-01678818 dated 1/19/15, pages 28-34).

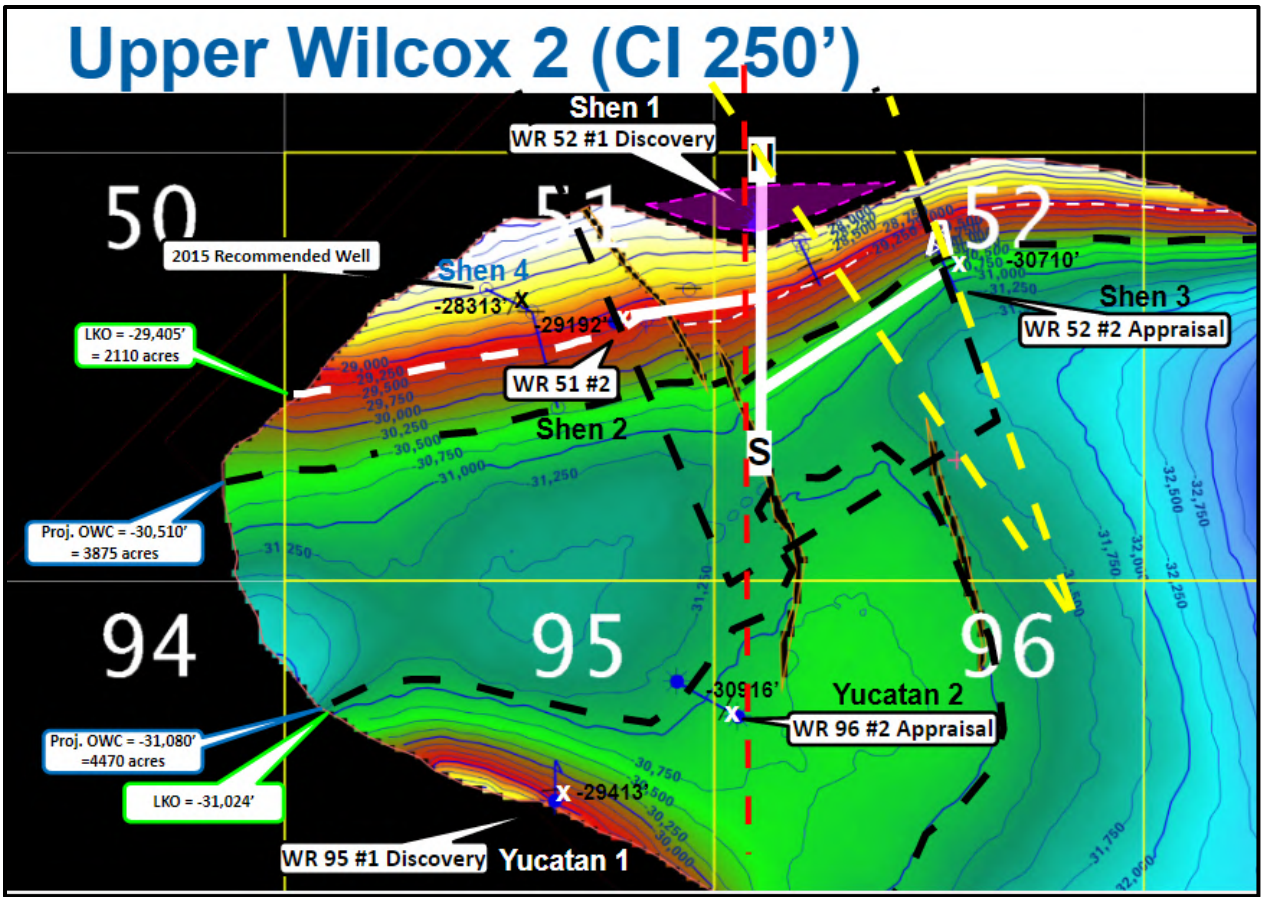

Exhibit 48: Structure Map for UW2 Zone – P90 and P10 Areas (APC-0168818, page 28) (November 2014)

204. The P90 (white dash) limit follows the contour at a depth of the lowest known oil in Shen-2 on the southern side of the structure but follows the same northern edge as the upside case. This downside case would be valid if the field's northern, eastern, and western limits were known with certainty and that no faults could isolate an oil field block from a water-bearing block. At this stage, COP had already mapped and shared with partners multiple north-south trending faults capable of causing isolation between blocks. In my expert opinion, the assumed P90 area significantly underestimated the potential downside risk in the extent of the oil accumulation. Note that the proposed location for Shen-4 was well within the P90 area indicating virtually no risk of a dry hole. The original Shen-4 wellbore at this location encountered salt instead of oil filled Wilcox sands, proving Exploration's estimate of the P90 downside area too optimistic.

205. Exhibit 49 shows the assumed P90 (white dashed line) and P10 (black dashed line) extents of the oil accumulation for the LWC horizon. In this horizon, the lowest known oil (the basis for P90) is at -30,727 ft. TVD, and projected OWC (the basis for P10) is at -30,900 ft. TVD, based on the assumption that Shen-2 and Shen-3 are in pressure communication across the mapped fault. The dashed lines are so close that they almost overlap, showing virtually no appreciable uncertainty in areal extent to the north, south, east, or west. In my expert opinion, this attempt at describing the range of possible outcomes is not credible and lacks professional judgment, showing minimal downside risk. Furthermore, all of the mapped Lower Wilcox horizons show an unrealistic level of certainty between the P90 and P10 areas.

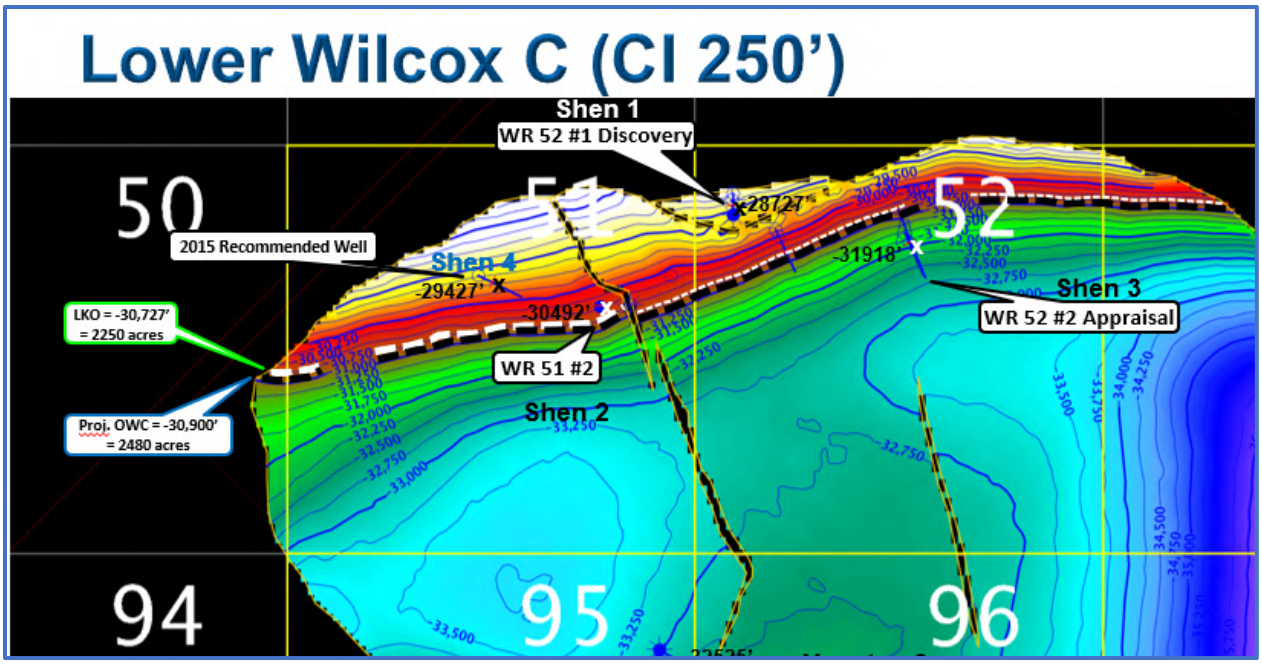

Exhibit 49: P90 and P10 Nearly Identical at LWC Horizon (APC-10678818, page 32)

206. Net pay assumptions increased by 32% from the June 2013 evaluation to the November 2014 update following Shen-3. The estimate for net pay, which, by definition, is oil-filled reservoir quality sands, needed to consider results encountered in the three wells drilled up to that time, plus seismic analysis indicating thinning of the Wilcox section toward the crest of the structure. Exhibit 50 summarizes net pay results[171] by horizon, porosity, and permeability results, along with Exploration's average net pay for the field, shaded in yellow.

	Shen-3			Shen-2			Shen-1			11/14 MMRA		
Zone	Net Sand, ft	Porosity %	Permeability, mD	Net Pay, ft	Porosity %	Permeability, mD	Net Pay, ft	Porosity %	Permeability, mD	P90 Net Pay, ft	Mean Net Pay, ft	P10 Net Pay, ft
UW1	214	17.7%	4	142	20.3%	37	NA	NA	NA	165	217	274
UW2	350	18.6%	9	240	21.8%	81	NA	NA	NA			
UW3	NA	NA	NA	23	21.1%	28	NA	NA	NA	240	269	300
LWA	267	18.5%	11	160	22.5%	77	30	22.9%	511	175	187	200
LWB	149	18.5%	17	139	22.0%	49	0	21.5%	258	125	132	140
LWC	60	17.8%	9	166	20.0%	21	39	21.4%	293	125	137	150
LWD	203	18.7%	17	38	16.0%	4	91	22.6%	127	80	90	100
LWE	227	17.2%	8	94	19.3%	18	76	25.0%	727	100	135	175
Total	1470			1002			236			1010	1168	1339
Average		18.1%	11		20.4%	39		22.7%	383			

Exhibit 50:Net Pay, Porosity, and Permeability of Shen-1, -2, and -3

207. Shen-1 is highest on the structure of these three wells and encountered only 236 ft. of net pay with the Upper Wilcox missing and wet sands through most of the LWA, LWB, and LWC horizons. Net reservoir sand totaled 463 ft., with approximately one-half of the sands water-bearing. Net pay in Shen-2, located down-dip of the crest and near the assumed OWC, totaled 1,002 ft. TVT with all sands filled with oil, making it the best pay result in the three appraisal

[171] APC-01678818 dated 1/19/15, pages 7-8.

wells. Shen-3, located 1,518 ft.[172] down-dip of Shen-2, was wet with no net pay but had 1,470 ft. TVT of reservoir sands, which would be expected considering the evidence for crestal thinning and down-dip thickening observed as early as 2009. Crestal thinning was observed in this period based on an annotation on a seismic cross-section:[173] "*Note thinning of Upper Wilcox interval onto Shenandoah structure*." On November 19, 2014, Ramsey wrote[174] about the need to account for crestal thinning in estimating the field average net pay and how this thinning higher in the structure was accounted for in Exploration's previous evaluation, yet his net pay estimates in paragraph 206 are based on thickening toward the crest rather than thinning.

> *"3.) Beth and I will need to output and study the isopach mapping for the Upper Wilcox. The upper Wilcox has been identified as having potential to stratigraphically pinch out before the crest of the structure, so we need to assess if there are any locations along the crest which thin out and potentially don't contain reservoir (or res that is likely not supportive of a completion). The basics of this premise lies in the fact that the discovery well does not have UW, and the Yucatan discovery well has very poorly developed UW sands (high on structure). Last time we did this exercise, we carved out an area at the crest of structure, that did not meet a 'critical isopach thickness.'"*

208. Earlier in the same email, he highlighted the process followed in previous work that digitized net pay isopachs to calculate average net pay value. He also mentioned that this mapping exercise would require five-to-seven days to complete and would be revisited in round two of their evaluation. The author was unable to find documentation of round two and the net pay estimates remained unchanged throughout 2015, despite new and additional information severely reducing net pay from Shen-4.

> *"Last time we did the MMRA and given the importance of average reservoir thickness across the structure (main input on res storage capacity), we took the step of making net pay isopachs, digitizing the maps, and outputting the calculated average reservoir value. This step would take about 5 - 7 days, so will revisit this in round two of our assessment."*

209. On November 21, 2014, Ramsey provided[175] the P90 and P10 net pay estimates for each horizon, which are shown in the right-hand columns of Exhibit 50, stating they were based on net pay isopach maps provided by Kendall.[176]

> *"Gang, Attached are "scoping" TVT net pay #s that we can use in our MMRA update. I generated P90 & P10 net pay isopachs, off of TVT interval isopachs that*

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[172] APC-00881510, page 10.

[173] APC-00017078 dated 12/3/14, page 35.

[174] APC-00617317 dated 11/19/14.

[175] APC-00617367 dated 11/21/14, with attached Excel file APC-00617368.

[176] APC-00852415 dated 11/24/14, TVT isopach maps on pages 8-15.

Beth created, so we do have some basis for these #s. I would like to review them with you when possible, so we are all in alignment."

210. The Exploration team based their November 2014 evaluation on a mean net pay of 1,168 ft. for all horizons summed together, 17% greater than the Shen-2 result. P90 estimates for each horizon totaled 1,010 ft., similar to but greater than the Shen-2 result. Because the P90 areas were based on the lowest known oil (LKO) in Shen-2 for all horizons, nearly all the P90 areas must be up-dip of Shen-2. With crestal thinning, net pay would decrease up-dip, resulting in a lower average net pay than Shen-2. A thicker average net pay up-dip of Shen-2 is very unlikely with crestal thinning. Instead of accounting for crestal thinning in their estimate, this study was based erroneously on finding thicker sands up-dip of Shen-2.

211. The sum of their P10 estimates is 1,339 ft., 34% larger than the Shen-2 total, and requires substantial thickening higher in the structure, which is precisely opposite of the evidence for crestal thinning. In my expert opinion, assuming such thickening higher in the structure was unjustified and incorrect.

212. The mean net pay total assumed in the June 2013 evaluation was 888 ft., reflecting some thinning above Shen-2. In my expert opinion, the ranges assumed for the November 2014 evaluation were overstated by at least 30%. The June 2013 net pay ranges were optimistic but more credible and consistent with actual well results and the observed crestal thinning.

213. A different resource estimate labeled "Fault Model" with a mean of 740 MMBOE is shown in a bar chart in Exhibit 51 from a post-Shen-3 presentation.[177] However, the author has not been able to find any MMRA or Multi-Zone Master files that appear related to this evaluation after extensive searches.

[177] APC-01678818 dated 1/19/15, page 37.

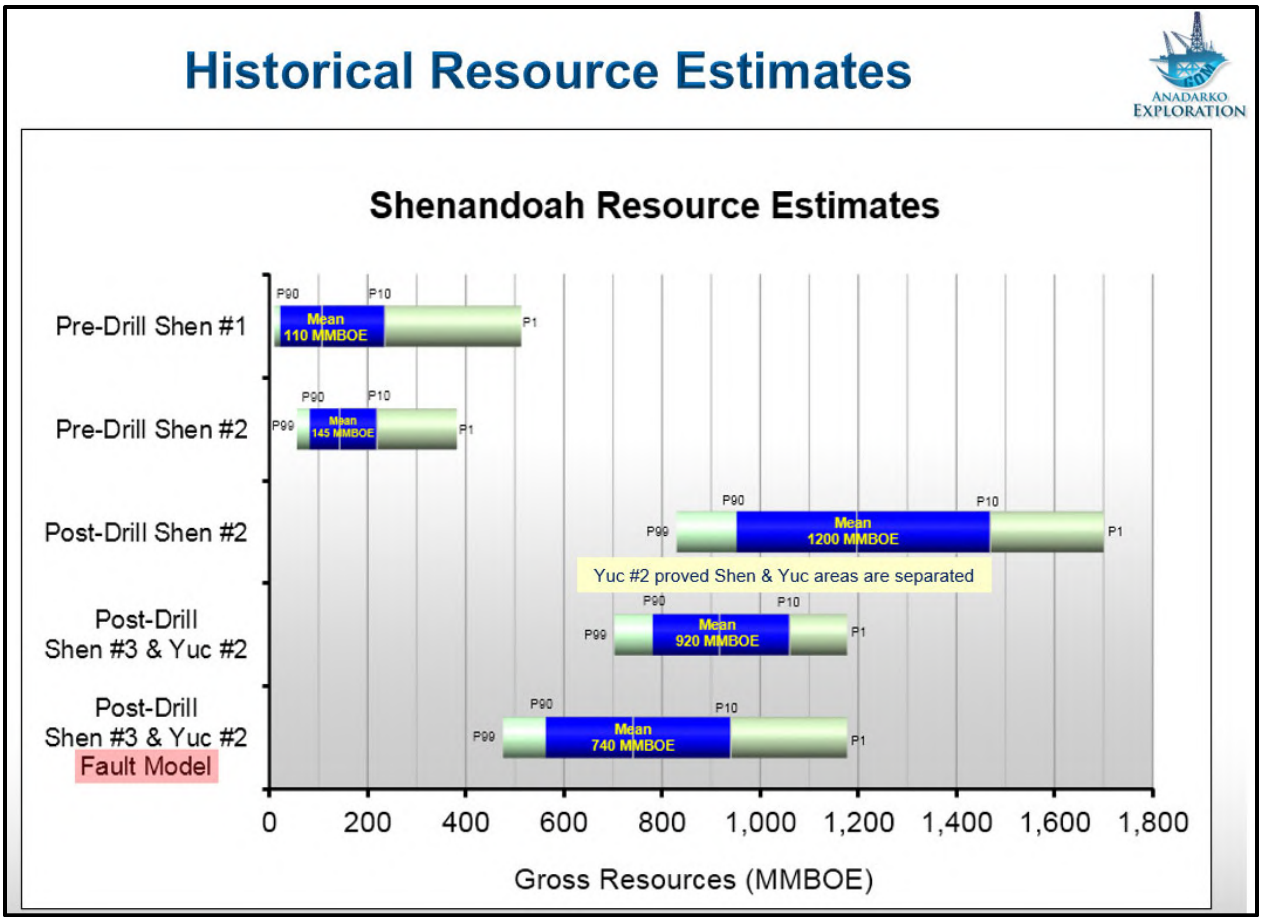
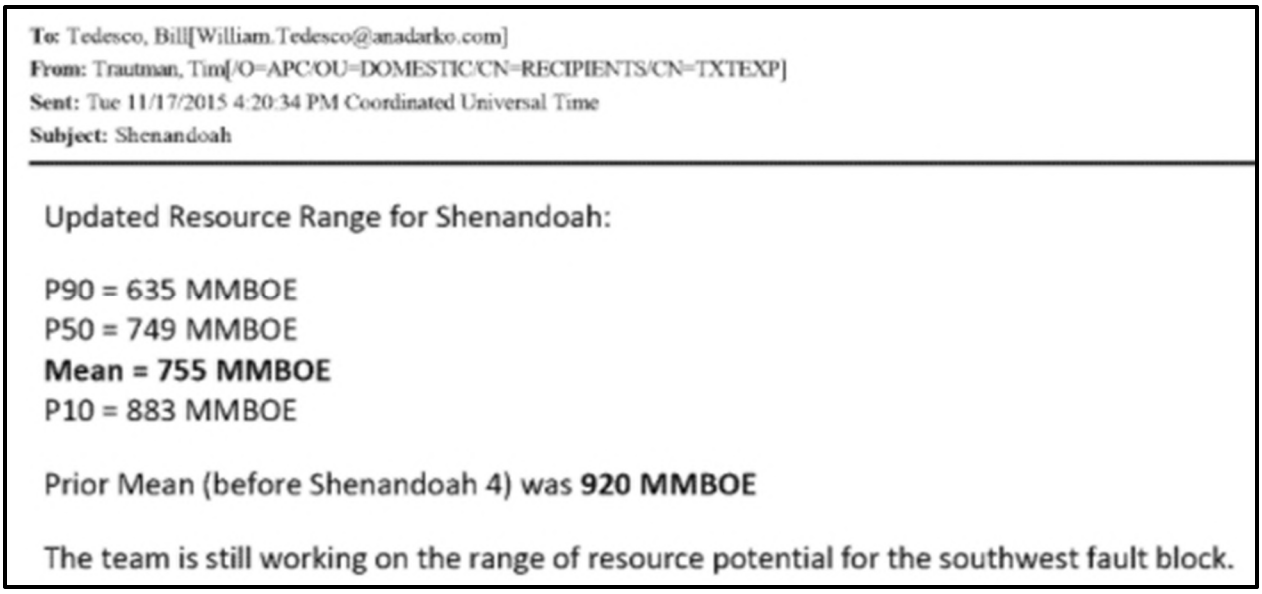


Exhibit 51: Display of "Fault Model" Resource Estimate (1/19/15)

214. An email[178] shown in Exhibit 52 from Trautman (Exploration Manager) establishes that the mean resource estimate of 920 MMBOE before Shen-4 was the version preferred in this period by Exploration over the "Fault Model" with the mean of 740 MMBOE. The email also highlights an updated case Post Shen-4 with a mean size of 755 MMBOE, discussed in the next section.

[178] APC-00209545, dated 11/17/15.



To: Tedesco, Bill[William.Tedesco@anadarko.com]
From: Trautman, Tim[/O=APC/OU=DOMESTIC/CN=RECIPIENTS/CN=TXTEXP]
Sent: Tue 11/17/2015 4:20:34 PM Coordinated Universal Time
Subject: Shenandoah

Updated Resource Range for Shenandoah:

P90 = 635 MMBOE
P50 = 749 MMBOE
Mean = 755 MMBOE
P10 = 883 MMBOE

Prior Mean (before Shenandoah 4) was **920 MMBOE**

The team is still working on the range of resource potential for the southwest fault block.

Exhibit 52: Confirmation That Exploration's Pre-Shen-4 Resource Mean Was 920 MMBOE (11/17/15)

E. Post Shen-3: Development Team

215. After Shen-3, Development's resource estimates shrank by more than half. The Development Team's pre-Shen-4 resource mean was 396.9 MMBOE, which was 57% percent smaller than Exploration's estimate of 920 MMBOE. In my expert opinion, such a large difference in resource size was a major red flag that necessitated reconciliation and senior management's attention. Moreover, Development's resource mean more accurately incorporated the risks and was substantially more credible. I will discuss the basis for Development's resource estimates and the support for my conclusions below.

216. There is evidence that senior management was concerned about the large difference in resource size. This statement from Hollek to McGrievy indicates that Chuck Meloy, a member of the Executive Committee at the time, was concerned that Anadarko's portfolio contained Exploration's over optimistic numbers:

> Hollek to McGrievy:[179] *"One of the issues I know Chuck still has is that Portfolio still contains Exploration scenario which he knows is different than our runs. Like I told him our numbers are built on the latest assumptions of costs and activities on what we know today."*

217. An important finding from Shen-3 was that the Development team observed that aquifer pressure trends[180] in Shen-1 and Shen-3 both followed the same 0.50 psi/ft. regional pressure gradient as shown in Exhibit 53. This similarity establishes possible but not proven pressure continuity between the two wells and such a connection, if true, had strong negative implications to the areal extent of oil. Shen-1 encountered water-bearing sands near the crest of the fault block, and the much shallower OWCs established by water-bearing sands in the LWB

[179] APC-00025540 dated 03/24/15.

[180] APC-00157431 dated 1/26/15, page 29.

and LWC sands would therefore extend across much of the eastern fault block if Shen-1 were connected to Shen-3.

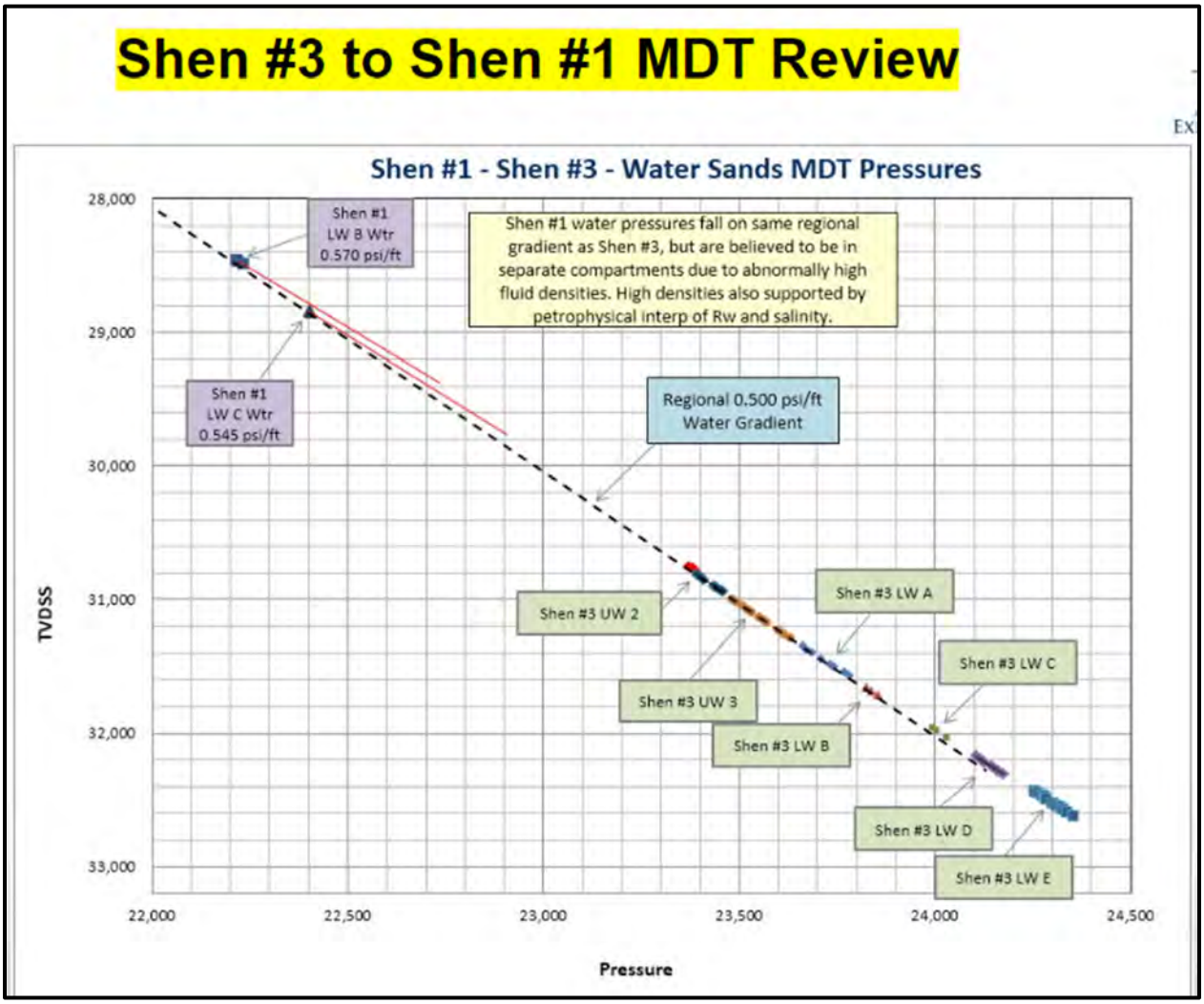


Exhibit 53: Shen-3 to Shen-1 MDT Pressures

218. The oil in place volume for the eastern block was calculated[181] by Shotts to be only 85 MMSTB assuming the Shen-1/Shen-3 connected model, described as follows: "*This is the results of Oil In Place for 'East Shenandoah' using the projected OWC from based on Shen 3 for the Lower Wilcox sands assuming Shen 1 and Shen 3 are connected*." McGrievy responded in the email chain that such a small volume was likely uneconomic even for a single-well tieback scenario as follows: "*Shy of break-even economics if you are to assume a single SS tieback well at 10% primary recovery*."

[181] APC-00017196 dated 12/4/14.

219. An earlier quote from a Ramsey email[182] as Shen-3 was being drilled demonstrated that the Exploration team recognized the implications if Shen-1 were not isolated from the rest of the field as follows:

> Ramsey: *"The first step I will personally take is to make sure the water gradients we are measuring do not line up with the Shenandoah discovery well [Shen-1], and then check if they line up with the Yucatan appraisal well."*

220. The Development Team recognized considerable uncertainty in the Eastern Fault block by including the Shen-1/Shen-3 connection as a possible outcome in their P90 area distribution described in the following evaluation. The Exploration Team dismissed the possibility of the two wells being connected despite recognizing that they were the same regional pressure gradient of 0.50 psi/ft.[183] In my expert opinion, Exploration's basis for dismissing pressure connection between the two wells due to high fluid densities near Shen-1 lacks credibility.[184]

221. On March 23, 2015, Frye sent Hollek a presentation[185] summarizing an evaluation of a Phase 1 development that included just a fraction of the full field resource volume. The risked rate of return was uneconomic at only 8%, but these economics are likely not significant because only a fraction of the resource was assumed to be developed. In the email[186] Frye sent to Hollek containing this presentation, she mentions working on other phases leading to a full field development analysis.

222. On April 8, 2015, the Development team presented to Kleckner an MMRA-based volumetric model[187] for the full field, shown in Exhibit 54 below, for the Shen discovery with an untruncated geologic mean of 396.9 MMBOE, 57% smaller than the value carried by the Exploration estimate of 920 MMBOE discussed above. In my expert opinion, such a large difference in resource size between two teams within the same company should have been a warning flag that required the attention of senior management to reconcile.

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[182] APC-00838530 dated 10/1/14.

[183] APC-00157431 dated 1/26/15, pages 30-31.

[184] APC-00157431 dated 1/26/15, pages 30-31.

[185] APC-00025533 dated 3/23/15.

[186] APC-00025532 dated 3/23/15.

[187] APC-00169083 dated 4/8/15, page 12, Kleckner custodian.

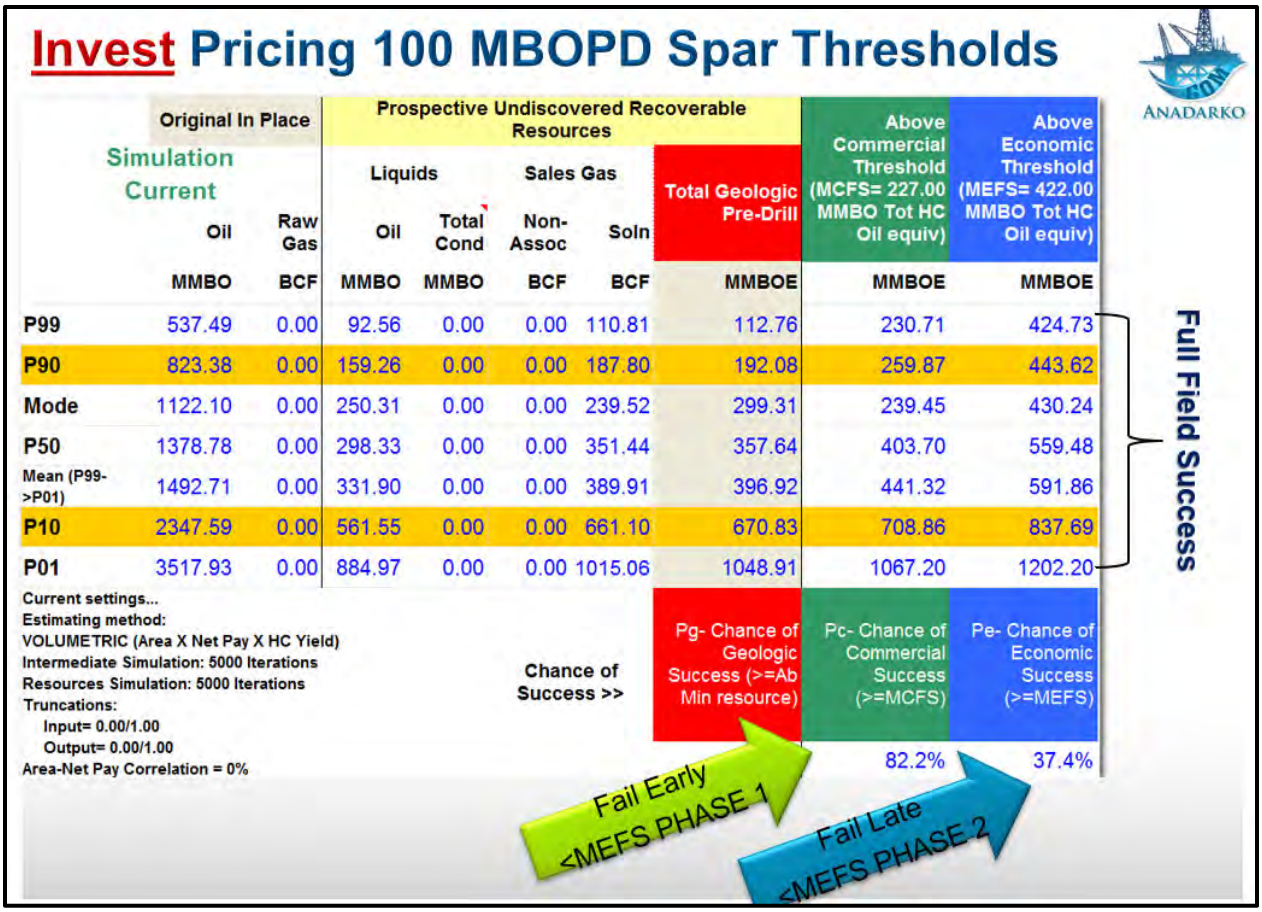
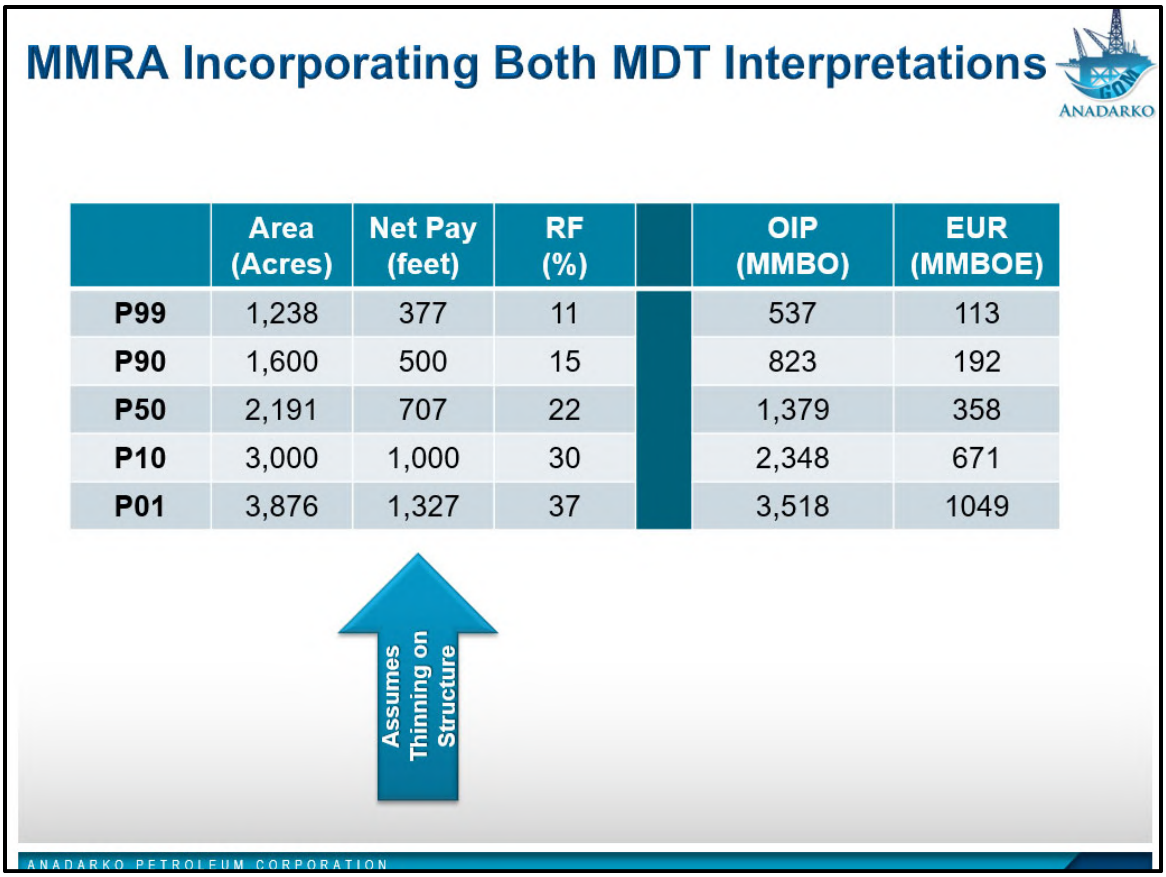


Exhibit 54: Development's MMRA Model with 397 MMBOE Mean

223. The Development team used a simplified approach of combining all sands into a single total net pay distribution for all horizons combined, requiring only one MMRA file to complete the estimate. The uncertainty ranges for the area, net pay, and recovery factor are provided in Exhibit 55 below.[188] The range for the area was based on two interpretations of the MDT pressure gradients. The P10 value of 3,000 acres for the area is based on the interpretation that Shen-2 and Shen-3 are in pressure communication. The depth of OWCs extrapolated from MDT data establishes the contacts for the eastern and western areas,[189] requiring one aquifer pressure regime for the entire field. The P90 value of 1,600 acres for the area assumes that Shen-3 pressures establish the OWCs in the western part of the field but that Shen-1 aquifer pressures establish shallower OWCs in the eastern part of the field.

[188] Same, page 7.

[189] Same, pages 4-6.



	Area (Acres)	Net Pay (feet)	RF (%)		OIP (MMBO)	EUR (MMBOE)
P99	1,238	377	11		537	113
P90	1,600	500	15		823	192
P50	2,191	707	22		1,379	358
P10	3,000	1,000	30		2,348	671
P01	3,876	1,327	37		3,518	1049

Exhibit 55: Key Input Assumptions for MMRA Model

224. The P90 to P10 range in average net pay across the field was 500 ft. to 1,000 ft., with a comment written on the slide that "thinning on structure" was assumed. The upside P10 value of 1,000 ft. is consistent with Shen-2 representing the upper range of potential outcomes.

225. The downside P90 assumption of 500 ft. is consistent with the Shen-1 net sand count of 478 ft. representing the bulk of the area higher in the structure. The hypothesis of thinning on the structure was strongly supported by the annotated seismic cross-section shown in Exhibit 56.[190]

[190] Same, page 8.

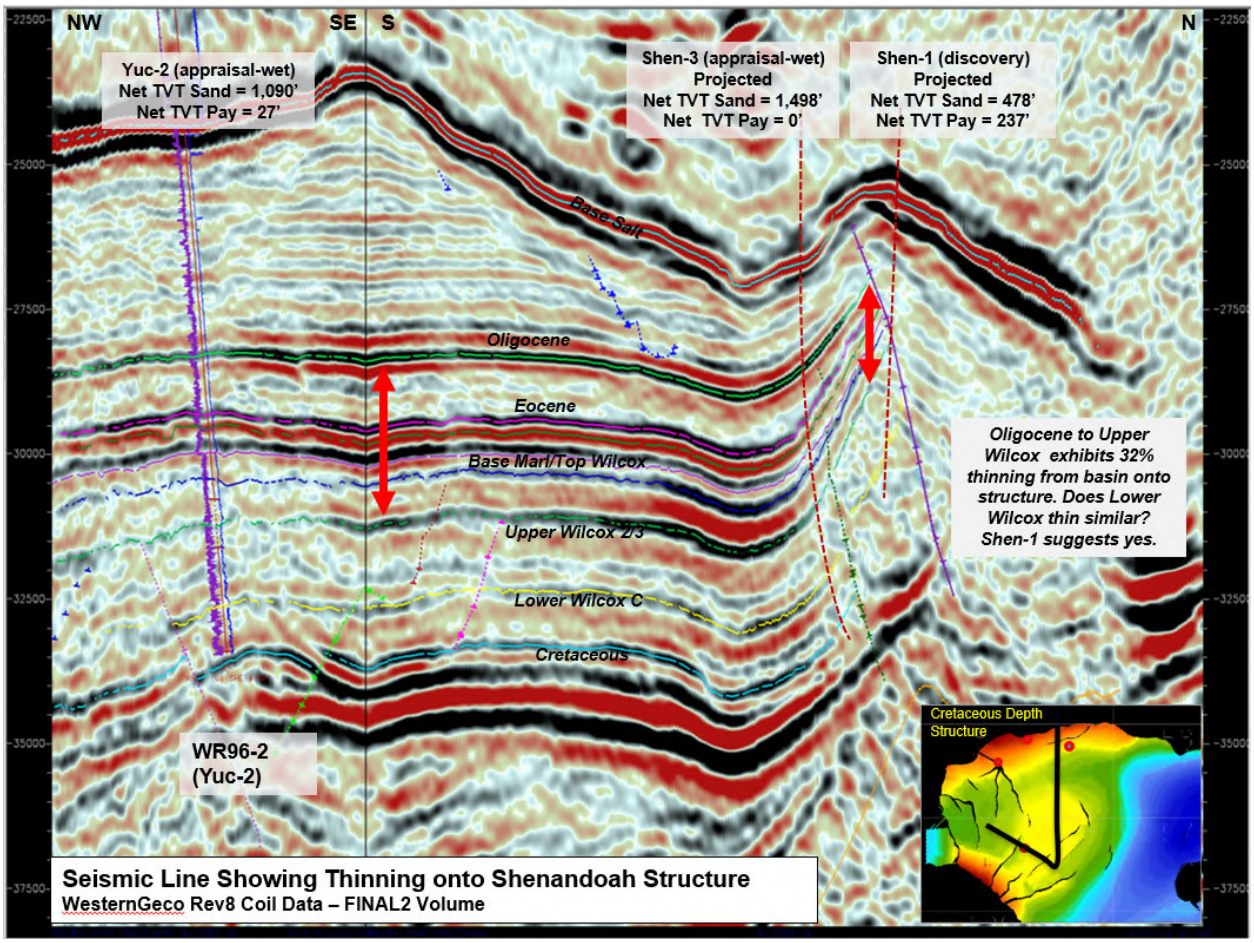


Exhibit 56: Seismic Line Shows Thinning on Structure

226. Finally, the Development team assumed recovery factors ranging from 15% to 30% for the P90 to P10 values. This range was partially consistent with Shotts' reservoir simulation modeling work[191] that showed potential recovery factors being highly sensitive to fault barriers, with a 26% recovery factor for an unfaulted continuous case decreasing to 15% for a north-south faulted scenario. Shott's work also showed a much lower recovery factor of 5% for a scenario with moderate east-west faulting, complicating pressure support from injectors/aquifers and producers. Such a low recovery factor of 5% was less than the P99 assumption value, so it was not represented in the possible range of outcomes, leaving the assumed range of recovery factors as potentially optimistic. An email[192] between Shotts and Frye demonstrated the two reservoir engineers worked closely together on how they described faulting, with Frye quoted below:

> *"**Based on the dialog/politics between exploration and development we have removed all references to faults** and I desensitized the verbiage to remove any word that says 'fault' and made the language barriers/compartmentalization." (Emphasis added.)*

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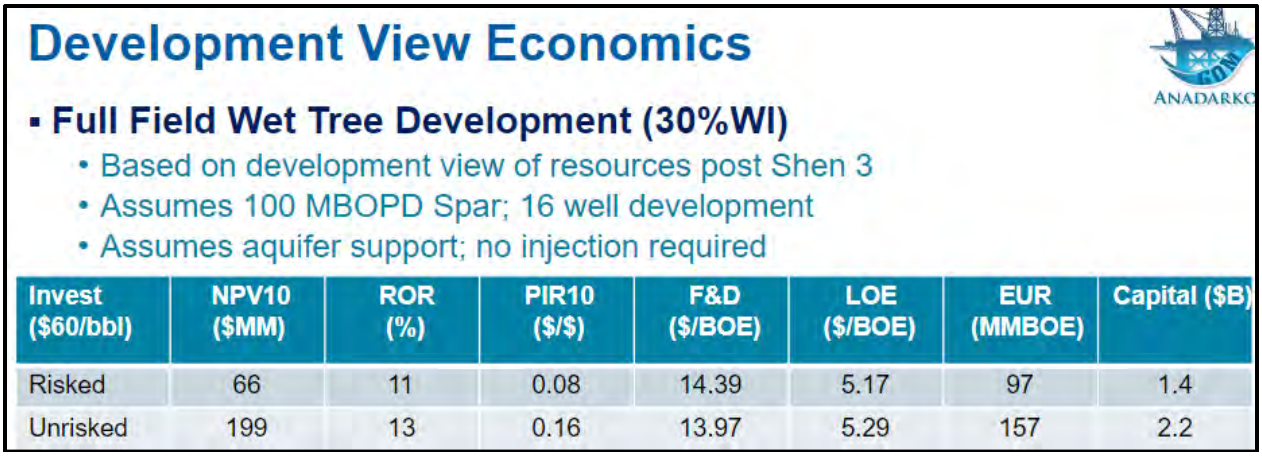
191 APC-00137267 dated 8/19/14, pages 44-48.

192 APC-00612283 dated 8/22/14.

227. Based on searches of the documents available, the MMRA evaluation of April 19, 2015 appears to represent the first full-field update by the Development team following the results from Shen-3. By removing almost half of the upside area (based on Shen-3 being wet) on the southern side of the structure and accounting for thinning onto the structure, the Development team's mean resource estimate of 397 MMBOE decreased by 57% from the previous year's estimate of 767.5 MMBO, equivalent to 931 MMBOE[193] with the associated gas equivalent included. In my expert opinion, the Development team's assessment is substantially more credible than Exploration's model, which ignored crestal thinning and assumed the opposite.

228. On April 8, 2015, the Development team presented a risked economics evaluation[194] for a full field development to Kleckner with a rate of return of just 11%, substantially lower than the 19% rate of return presented on February 19, 2014, with results shown in Exhibit 57. The decline in profitability resulted from a much-reduced resource volume and a lower oil price environment. Following significant oil price declines in early 2015, the base case oil price used in Anadarko's economics was reduced from $95/bbl to $60/bbl.

229. The PIR10 in this risked economics evaluation is noteworthy for two reasons. The first is it falls well below Anadarko's .3 threshold for commerciality, at .08 for risked economics. Second, even though this analysis showed Shen was uneconomic, it was incorporated overly optimistic assumptions. Specifically, this analysis was based on the optimistic assumptions that no east-west faulting existed to limit aquifer support and no damage to flowrates occurred from asphaltene deposition.



Invest ($60/bbl)	NPV10 ($MM)	ROR (%)	PIR10 ($/$)	F&D ($/BOE)	LOE ($/BOE)	EUR (MMBOE)	Capital ($B)
Risked	66	11	0.08	14.39	5.17	97	1.4
Unrisked	199	13	0.16	13.97	5.29	157	2.2

Exhibit 57: Development View Economics Post Shen-3

230. The net present value discounted at 10% was only $66 MM for a project with a success case investment of $6 billion to $10 billion. In my expert opinion, the results from Shen-3 caused resource estimates to decrease by more than 50%, seriously impacting the project's commercial viability. This finding sharply contrasts with senior management describing Shen-3 as a successful appraisal well.

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193 Assuming a gas:oil ratio of 1,280 scf/bbl and a gas equivalency ratio of 6,000 scf/BOE.

194 APC-00169083 dated 4/8/15, page 2, Kleckner custodian

F. Post Shen-3: COP

231. COP's decisions around Shen's commerciality and viability after Shen-3 are particularly informative. Partner unity and approval can act as a form of peer review of the operator. Partners typically provide professional staff to perform their own analysis. Over time COP developed a more pessimistic view of Shen, leading to an eventual decision to sell their interests. COP's estimated resource volume at this time of 360 MMBOE was quite similar to Development's estimate of 396 MMBOE and less than half of Exploration's estimate. Senior management was made aware of this number when COP tried to trade its share in Shen for a different Anadarko asset.

232. As Shen-3 was being drilled but before wet sands were detected, COP discussed concern over Shen's viability. COP had calculated volumetric sensitivities with new maps and uncertainty ranges for OWCs and saw volumes decline by half. Smallwood (COP) informed Frye that they were very concerned about Shen's size and commercial viability. Frye wrote[195] McGrievy about the exchange with Smallwood as follows:

> *"Interesting. Dan from COP called me and wanted to chat. Based on Shen 1 pressures and the new interpreted rafts areas COP is concerned. He has run some volume sensitivities with new maps and OWC variance and is seeing in place volumes basically cut in half. They are very concerned about size and commerciality."*

233. On March 10, 2015, COP inquired[196] as quoted below about an asset trade of COP's share of Shen for Anadarko's share of the Alpine asset in Alaska. Such a trade indicates that COP was interested in ridding itself of the Shen appraisal program, especially after COP expressed its concern over the commercial viability mentioned above.

> *"Subject : Alpine - Shenandoah – Conoco*
>
> *John Schell, BD NA Conoco, called and wanted to know if we would consider an Alpine-Shenandoah trade. I told him I would check to see how much interest we might have. If interested he will vet further in COP. He said they have been kicking it around but I am not sure how high that goes. Thoughts? Budget issues?*
>
> *Jerry Windlinger, Vice President, Corporate Development"*

234. Anadarko's evaluation of the trade[197] shows COP's estimate of Shen's gross resource as follows: "*COP Range of Resources: Most Likely (ML): 360 MMBOE gross.*" This volume is similar to the Development team's Post Shen-3 estimated mean of 397 MMBOE gross discussed in the previous section and is more than 2.6 times smaller than Exploration's outlier mean of 920 MMBOE gross.

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[195] APC-00013459 dated 10/2/14.

[196] APC-00023888 dated 3/10/15.

[197] APC-00171344 dated 4/20/15, page 2.

235. On 10/19/15, COP announced[198] they would discontinue deepwater exploration by 2017:

> *"On a conference call with analysts, executives said ConocoPhillips planned to exit all deepwater exploration by 2017 as other projects win out in the budgeting process."*

G. Shen-4

236. The results from drilling the Shen-4 well were disappointing, with the original hole drilling into the margin edge without reaching any Wilcox sands,[199] reducing the potential oil-in-place by a substantial one-third or 900 MMBOE in the mid-case. Figure 49 shows that the original borehole targeted well inside Exploration's P90 area, proving their assessment of downside uncertainty far too optimistic. The first sidetrack – Shen-4ST1 – encountered 626 ft. of pay with all UW1, part of UW2, and all UW3 sands missing, likely due to faulting. The LWD sand was wet and had low porosity, and the LWE appeared to be a mix of water and hydrocarbons.[200] Finally, the MDT pressure data confirmed that Shen-4ST1 and Shen-2 were in separate pressure compartments. Two additional faults were added between Shen-2 and Shen-4ST1 structure map[201] to help explain the results from the well. These findings provided substantial evidence Shen was no longer commercially viable.

H. Post Shen-4ST1: Exploration Team

237. Following Shen-4 ST1, the Exploration team revised their resource evaluation downward on November 17, 2015 to account for findings from Shen-4, producing the following comparison to earlier evaluations.[202] Their mean estimate of resource size decreased 18% from 920 MMBOE to 754 MMBOE based on initial results from the Shen-4ST1. Appendix C explains how the layers were combined to estimate the field resource volume and shows the files used in this process. Exhibit 58 shows the declining trend in Exploration's estimate of resource volume.

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[198] https://www.hartenergy.com/exclusives/conocophillips-plans-deepwater-exploration-exit-cuts-spending-27816.

[199] APC-00188661 dated 8/15/15.

[200] APC-00001914 dated 9/30/15.

[201] APC-01699915 dated 11/12/15, page 4 for pre-Shen-4, and page 7 for post-Shen-4.

[202] APC-01006394 dated 11/30/15, file name "Shen Resource Estimates -Daniels 2015-11-17.pptx."

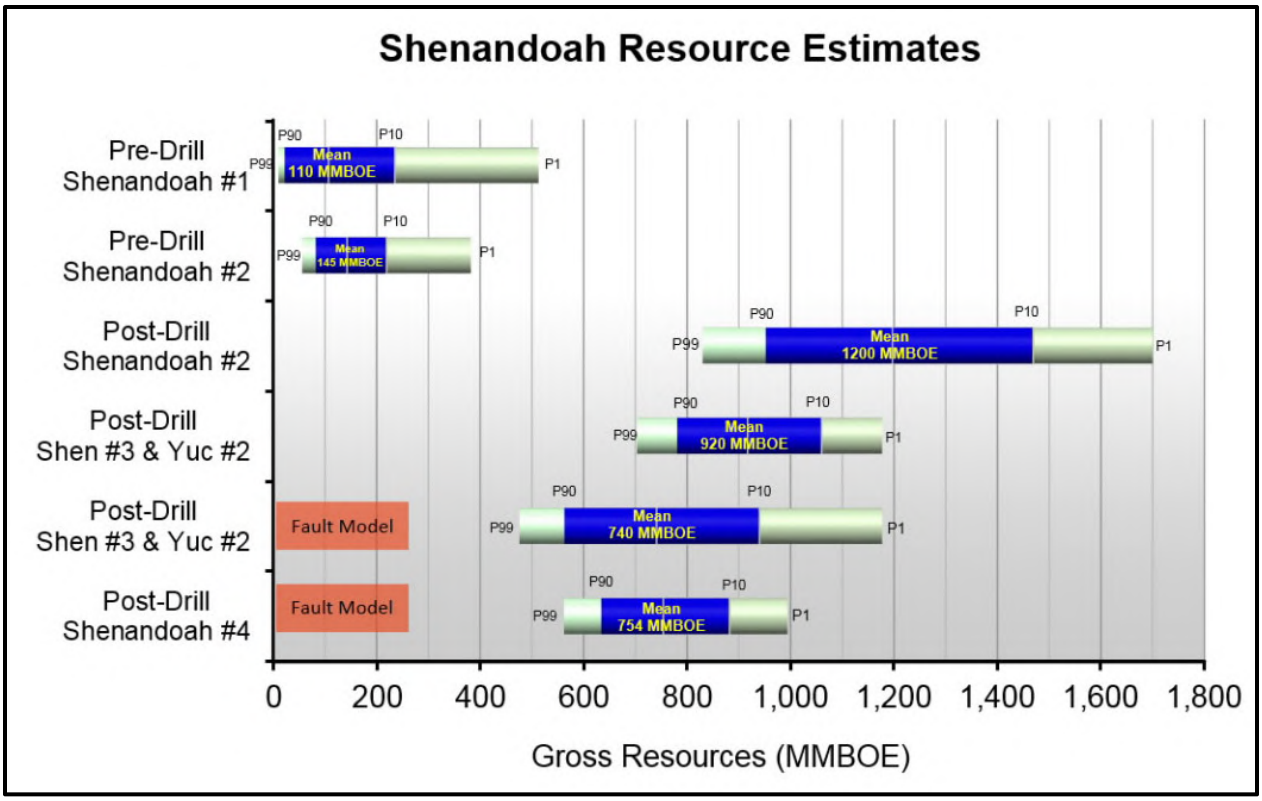

Exhibit 58: Post Shen-4 Resource Estimate

238. The only changes in assumptions from the November 2014 MMRA evaluation to the November 2015 evaluation were the assumed area ranges. In this evaluation, the field area was divided into three fault blocks in the western part of the field and one block in the eastern part of the field, with an example shown in Exhibit 59.[203] Labels for the fault blocks are in small black lettering as follows:

[203] APC-01004346 dated 11/18/15, page 7.

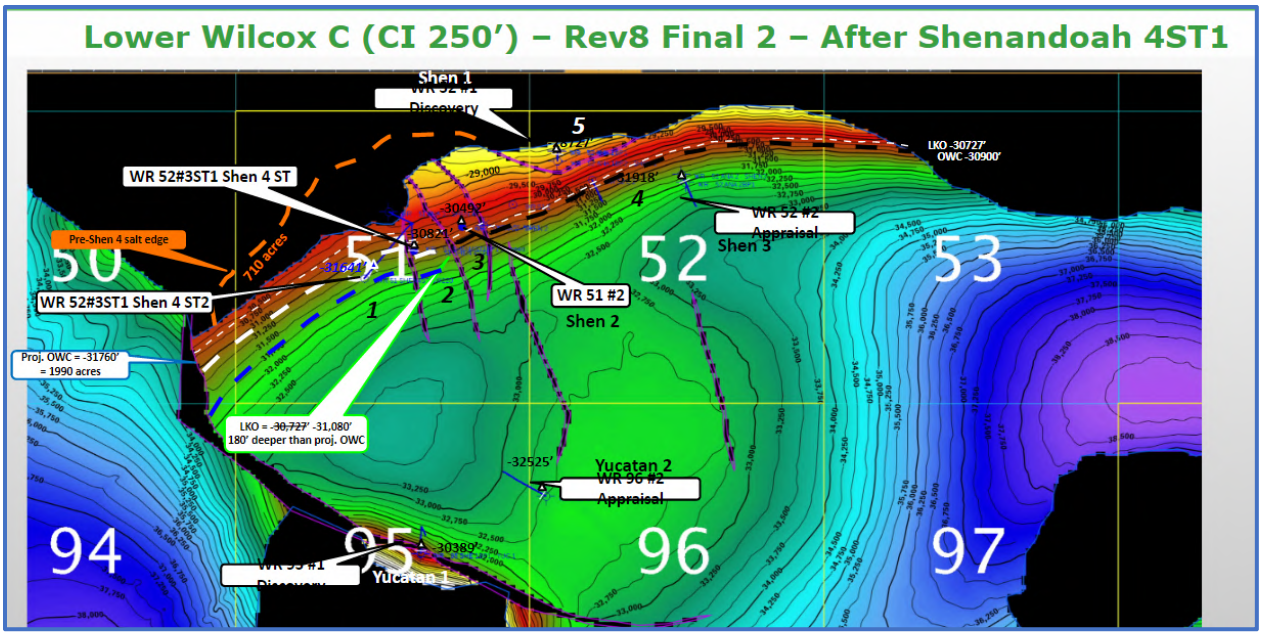

Exhibit 59: Updated Structure Maps and Blocks 1-4

239. Exhibit 60 compares assumed ranges for the areal extent of the oil accumulation by horizon. Based on structure maps[204] used in their analysis, the salt body penetrated in the original Shen-4 wellbore was estimated to reduce the areal extent of the oil accumulation by 910 acres in the Upper Wilcox sand, and by 600 fewer acres at the deeper LWD and LWE horizons.

Area Estimates for MMRA 11/15 Evaluation and Comparison with MMRA 11/14, acres											
Layer	Range	West Fault Blocks			East Fault Block	Total	Post Shen-4	Post Shen 3	11/15- 11/14	Shen-4 Salt	Source files for
		1	2	3	4	Sum 1-4	MMRA 11/15	MMRA 11/14	Difference	Reduction	MMRA 11/15
UW1&2	P90	320	190	195	945	1650	1650	2110	-460	-910	APC-01699930
	P10	800	310	310	1700	3120	3120	3875	-755		
UW3	P90	70	106	193	1065	1434	1434	2402	-968	NA	APC-01699931
	P10	482	230	263	1566	2541	2541	3570	-1029		
LWA	P90	314	140	208	1070	1732	1740	2235	-495	-710	APC-01699933
	P10	660	190	250	1390	2490	2490	2900	-410		
LWB	P90	330	135	200	1050	1715	1715	2135	-420	NA	APC-01699932
	P10	535	165	240	1370	2310	2310	2750	-440		
LWC	P90	560	140	206	1110	2016	2016	2250	-234	-710	APC-01699934
	P10	1000	200	215	1220	2635	2635	2480	155		
LWD	P90	266	72	200	1085	1623	1623	2215	-592	-600	APC-01699935
	P10	576	72	245	1405	2298	2226	2805	-579		
LWE	P90	550	105	186	1045	1886	1886	2160	-274	-593	APC-01004124
	P10	1630	105	245	1560	3540	3435	3040	395		
					Average of All layers, P90		1723	2215	-492		
					Average of All layers, P10		2680	3060	-380		
			Sources:		*Fault block data from APC-01004346, page 2.*						
					MMRA 11/14 from Exhibit 48						
					MMRA 11/15 from files lised in far right column						
					Shen-4 salt reductioon from maps in APC-01004346, pages 3-9						

Exhibit 60: Comparison of Area Assumptions Pre and Post Shen-4 (11/18/15)

240. When adjusted for depth, Shen-4ST1 pressures in the oil column were higher than those measured in Shen-2. The Exploration team assumed that the higher oil pressures overlaid

[204] APC-01006395 dated 11/30/15, pages 3-9.

the same aquifer pressure gradient measured in Shen-3, despite being separated from Shen-4 by a distance of over three miles and numerous recognized faults, resulting in a deeper projected OWC, especially in the LWC and LWE horizons. In my expert opinion, evidence for faulting was too abundant to continue with the hope that Shen-3 and Shen-4ST1 were in pressure communication to project the OWCs. Shen-4ST1 did not even communicate with Shen-4BP1, which was only 300-400 ft. away.

241. At the LWC horizon[205], the revised mapping of the salt body encountered by the Shen-4 original wellbore reduced the areal extent of oil-bearing sands by 710 acres, but the assumed OWC was deepened from -30,900 ft. TVDSS to -31,760 ft. TVDSS based on Exploration's aggressive interpretation of pressure continuity between Shen-4ST1 and Shen-3, resulting in a P10 area increase of 155 acres compared to the November 2014 MMRA evaluation.

242. At the LWE horizon, the salt intrusion was expected to decrease the area of oil-bearing sands by 593 acres, but the depth of the estimated OWC was lowered by an extraordinary change of 1,200 ft. from -30,900 ft. TVDSS to -33,100 ft. TVDSS. With higher pressures and the assumption of continuity with Shen-3, the P10 area increased by 395 acres by projecting a deeper OWC.

243. In my expert opinion, such a large change to the projected OWC is improbable given the petrophysical analysis indicating a mix of water and hydrocarbons in the LWE sand[206] in Shen-4ST1, with 14 ft. of water-bearing net sand that did not qualify as net pay[207] due to high water saturation. The unexplained presence of high water saturations 1,400 vertical ft. above the OWC is very improbable, and the actual OWC was likely to be much shallower. Based on my expert opinion, it was highly unlikely that Shen-3 and Shen-4ST1 were in pressure communication through an aquifer given the more than 15,000 ft. lateral distance between the wells, unexplained water sands in the LWE sand of Shen-4ST1, several intervening mapped faults, observed pressure compartmentalization, and extensive evidence for faulting.

244. Oudin later observed in an email[208] that the LWE zone in the Shen-4ST1 was near the water zone as follows:

> *"LWD is wet in all but one western fault block (Shen2). LWE is possibly on-water in Shen4 ST1 and has potentially shaled-out less than 400' away in Shen4 ST1 BP1. I'm so confused: Is Shen1 disconnected, but its P99 resources are not? So they therefor[e] extend beyond its fault block boundaries?"*

245. Unfortunately, no MDT pressures were obtained in the wet LWD horizon of Shen-4ST1. Such pressure in the LWD water-bearing zone would have settled the issue of whether or

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[205] APC-01006395 dated 11/30/15, page 7 for LWC and page 9 for LWE.

[206] APC-00001914 dated 9/30/15, AFE for bypass core.

[207] APC-00663542 dated 1/13/16, petrophysics summary tables.

[208] APC-00666725 dated 1/28/16.

not the water-leg pressures in Shen-4ST1 were in communication with Shen-3. Exhibit 61 shows[209] the MDT pressure gradients by horizon for Shen-1, Shen-2 and Shen-4ST1, and the water pressure gradient measured in Shen-3, all normalized to TVDSS.

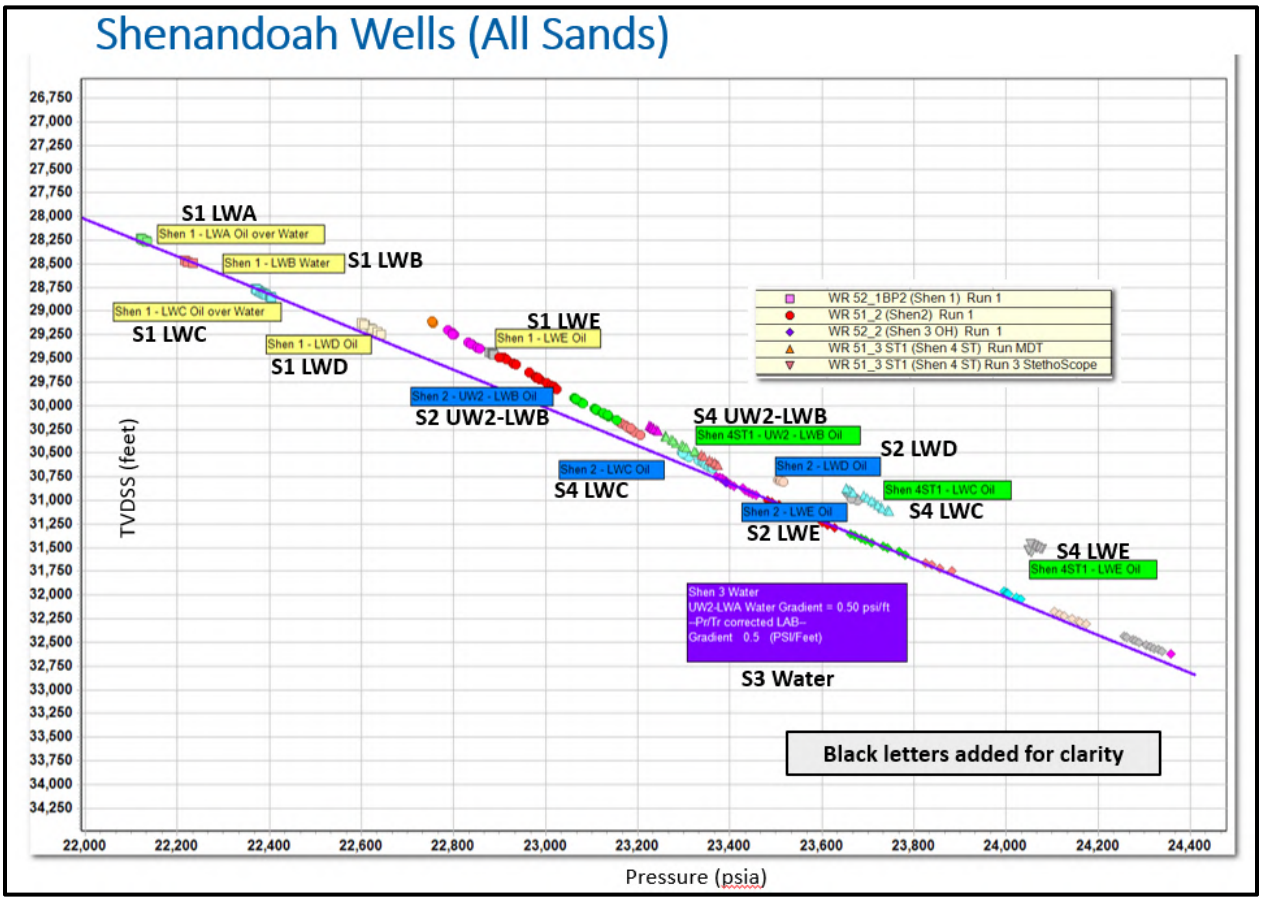

Exhibit 61: MDT Pressures – All Shenandoah Wells

246. In Shen-2, the pressure trends in the LWC, LWD, and LWE shift to the right with increasing depth, with the LWD gradient falling between LWC and LWE. In Shen-4ST1, the pressure trends between the LWC and LWE horizons follow the same shift to a higher-pressure gradient with increasing depth. If the LWD pressures in Shen-4ST1 fall between the LWC and LWE horizons gradients, the LWD water gradient would be 200-300 psi greater than the water gradient in Shen-3, proving isolation with Shen-3. In my expert opinion, it is improbable that the pressure gradient in the LWD sands of Shen-4ST1 would shift to the left of the LWC and LWE trends by 200-300 psi to follow the same gradient of Shen-3, making it highly unlikely that Shen-3 and Shen-4ST1 are in pressure communication through a shared aquifer.

247. The areas for the eastern fault were based on the same assumptions as the November 2014 MMRA evaluation. The lower end of the downside outcomes was vastly overstated by their P90 estimates, despite the findings from Shen-4 that highlighted the critical impact that complex faulting was having on the Shen discovery. Instead, the Exploration team's

[209] APC-01002485 dated 11/4/15, page 16.

model for the areal extent in the eastern block remained unchanged. The P90 area for the eastern blocks continued to show no downside risk of faults limiting the eastward and northern extent of oil and minimal risk of shallower OWCs.

248. The estimates for net pay assumed in the November 2015 MMRA evaluation remained unchanged from the November 2014 MMRA work, despite evidence from Shen-4ST1 that net pay in the well was 625 ft. TVT, providing further support for formation thinning higher on the structure. Simply taking the average of the three oil wells drilled up to this time yields an average of 621 ft, which is 47% less than the Exploration team's assumed mean of 1,168 ft. The P90 assumed net pay value of 1,010 ft. was similar to the best oil result encountered to this date, and the P10 value exceeded the best oil result by 34%. In my expert opinion, the estimate for the mean net pay of 1,168 ft. was extraordinarily optimistic and failed to recognize the results from analog wells and evidence for crestal thinning. Exhibit 62 compares assumed net thicknesses relative to the actual results from three wells. The Shen-4BP1 results were not yet available at the time of this study and were not included in the average discussed above.

	Shen-4BP1	Shen-4ST1	Shen-3	Shen-2	Shen-1	11/14 MMRA			11/15 MMRA		
Zone	Net Pay, ft	Net Pay, ft	Net Sand, ft	Net Pay, ft	Net Pay, ft	P90 Net Pay, ft	Mean Net Pay	P10 Net Pay, ft	P90 Net Pay, ft	Mean Net Pay	P10 Net Pay, ft
UW1	0	0	214	23	NA	165	217	274	165	217	274
UW2	0	61	350	142	NA						
UW3	0	0	NA	240	NA	240	269	300	240	269	300
LWA	114	116	267	160	30	175	187	200	175	187	200
LWB	147	150	149	139	0	125	132	140	125	132	140
LWC	212	227	60	166	39	125	137	150	125	137	150
LWD	0	0	203	38	91	80	90	100	80	90	100
LWE	0	71	227	94	76	100	135	175	100	135	175
Total	473	625	1470	1002	236	1010	1168	1339	1010	1168	1339
(Data for Shen-1-3 from APC-01678818 dated 1/19/15, pages 7-8)											
(Data for Shen-4 from APC-01170496 dated 2/26/26)											
(Data for MMRA values same as Exhibit 48)											

Exhibit 62: Comparison of Net Pay Assumptions to Well Results

249. Earlier in December 2015, Strickling emailed a presentation[210] representing Exploration's view of Shen economics. At the same oil price of $60/bbl as Development's analysis, Exploration's estimate of net present value discounted at 10% (NPV10) was shown as $1,526 MM in Exhibit 63. This result was extraordinarily higher than Development's NPV10 of -$185 MM, partly because Exploration's resource volume was inaccurately based on the post Shen-3 assessment instead of post Shen-4 update.

[210] APC-00214228 dated 12/7/15, page 6, file name "IDE 2015 Portfolio Summary Presentation Dec2015_FINAL_UPDATE.pdf" in email APC-00214227.

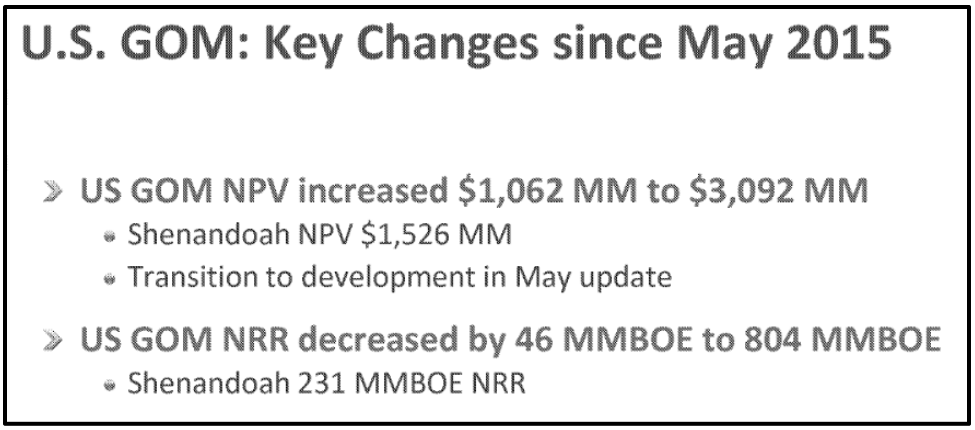

Exhibit 63: Exploration's Economics – Changes Since May 2015

250. Exhibit 63 shows Shen's net risked resource (NRR) as 231 MMBOE, which corresponds approximately to a gross volume of 920 MMBOE, assuming a net revenue interest (NRI) of 24.9%. The 920 MMBOE gross resource was Exploration's post Shen-3 resource estimate, not the revised Post-Shen-4 estimate. Exploration had already revised its resource estimate downward following Shen-4 to 754 MMBOE as shown in Exhibit 58. In my expert opinion, Exploration should not have submitted such obsolete and optimistic evaluation results after Shen-4 provided substantial negative findings.

I. Post Shen-4ST1: Development

251. On December 4, 2015, the Development team revised their resource assessment downward from a mean of 397 MMBOE to 304 MMBOE,[211] a 23% reduction in the mean. Exhibit 64 compares key input assumptions and results from Exploration's and Development's post-Shen-4ST1 resource assessment. Development's only significant change in input assumptions was that the P90 area was reduced by half from 1,600 acres to 800 acres, reflecting the highly negative result of encountering salt on the original hole and evidence for compartmentalization and crestal thinning from Shen-4ST1.

[211] APC-01701863 dated 12/4/15.

		Post Shen-4ST1	
		Development	Exploration
Block Areas		Combined	Combined*
Risk		100%	100%
Area, Acres	P90	800	1,723
	P10	3,000	2,680
Net Pay, ft	P90	500	1,010
	P10	1,000	1,339
Recovery Factor	P90	13.8%	20%
	P10	30.8%	30-35%
Resource, MMBOE	P90	100	635
	Mean	304	755
	P10	607	883
** sum of P90 and P10 values*			

Exhibit 64: Comparison of Assumptions, Development to Exploration

252. Exploration's mean resource estimate of 754 MMBOE was 2.5 times larger than the Development team's result, and their P90 estimate was larger by more than a factor of 6, presenting substantially different information on downside project risks. The upside P10 results differed by a smaller amount of 31%. The primary differences between the two teams were that Development's assumptions for P90 area and P90 net pay were both smaller by a factor of 2, and the P90 recovery factor was smaller by a factor of one-third. Exploration's process of summing multiple horizons also caused the variance to decrease substantially. Each layer of summation was based on the assumption of independence, which is discussed in more detail in paragraphs 179-183.

253. Oudin expressed his concern about the much larger value of Exploration's P90 resource estimate to McGrievy in an email[212] dated December 1, 2015 as follows:

> *"Saw this yesterday and was dumbfounded – again.*
>
> *P99 of 560 MMBO; P90 of 630 MMBO. Forget about the rest of it – Shenandoah is already guaranteed to be bigger than Tahiti, and potentially as big as Mars or Ursa.*
>
> *What if the missing UW2/UW3 sands in Shen-4ST are stratigraphically missing, and our sand story is more complicated across the discovery? What if the structure east of Shen2 is blown and wet, or if Shen1 and Shen3 are actually in communication? What if the structure is different than depicted on the maps behind these numbers? (yes, I've seen the maps, and I have some questions.)* ***None of these 'what if's' have been factored into the low end****. Based on these resources, we should be cutting steel already.*

[212] APC-00656539 dated 12/1/15.

This was presented to Mr. Daniels two weeks ago, so I assume Mr. Kleckner is aware of the resource range presented. Not sure if it factors into tomorrow's presentation, but I thought you should be aware of this." (Emphasis added.)

254. In a later discussion[213] with Oudin regarding these high value for P99 and P90, McGrievy states his opinion that Exploration's resource evaluation lacked any oversight by the RCT and was "*Simply Laughable*."

"There was clearly no oversight on these numbers; understandable why the RCT was never briefed on assumptions. Simply Laughable.

Patrick (Pat) L. McGrievy"

J. Economics Post-Shen-4

255. Economics Post-Shen-4The Development team presented economics[214] for the smaller resource distribution on December 17, 2015, showing negative project economics at $60/bbl pricing. The economics shown in Exhibit 65 were negative despite the wildly optimistic assumption of aquifer support with no need for injection, no degradation of well performance from asphaltene deposition, and 95% uptime. The P10 case also assumed more than 70 MMBOE/well recovery, an extraordinarily high value.

Economic Summary

	Invest $60/bbl		Upside $80/bbl				
	AT NPV10 ($MM)	AT PIR10	AT NPV10 ($MM)	AT PIR10	Mean Net EUR (MMBOE)	F&D ($/BOE)	P_c
Risked Mean	-185	-0.07	480	0.17	254	18.87	61.5%.
Unrisked Mean	-7	0.00	1,070	0.26	416	17.69	100%

Exhibit 65: Economic Evaluation with Negative Value at $60/bbl (12/17/15)

K. Post-Shen-4 Cost Reduction Initiative

256. When Shen transitioned over to Development after the drastic resource reduction and results of Shen-4, the evidence shows they were under pressure to cut costs to make Shen appear viable. In my expert opinion, these cost cuts and assumptions had no technical basis and Development's Shen-5 AFE presented overinflated economics. Moreover, even with the cost-cuts built into the economics, the outlook post-Shen-4 was bleak and the Executive Committee was made aware of that reality.

257. In an email exchange with McGrievy and Tule, Prosser,[215] a reservoir engineer for Development, listed several changes made to the economic assumptions, one of which was

[213] APC-01165872 dated 1/19/16.

[214] APC-00058253 dated 12/17/15, page 98.

[215] APC-00659407 dated 12/23/15.

reducing the contingency cost for facilities costs down to 14% instead of 28%. Tule, responsible for Facilities engineering, wrote to McGrievy about her concern over the lower contingency cost: "*We do not feel comfortable with a 14% contingency at this time for the facilities portion of this estimate*."

258. On the following day, McGrievy announced a team effort requested by Abendschein to address cost assumptions used for Shen economics in an email[216] titled "Shenandoah Project – Multi-Discipline Development Cost Assumptions Supporting Economics." In this email, he stated that Shen's "*overall economics are extremely stressed*," as quoted below:

> *"This is a high level, multi-discipline, open discussion to understand our base cost assumptions for the Shenandoah project and to identify room for further cost optimization. In light of the current poor commodity pricing environment,* ***the overall economics are extremely stressed*** *and we need to focus and need be reasonably confident in the investment costs that we are assuming for the project and identify opportunities to claw back on these costs. As a group. We also to make sure that we are not applying additional contingencies or double-dipping. This meeting will be a prelude to larger technical meeting with the greater Shenandoah project team to review and ground-truth our current project costs." (Emphasis added.)*

259. Explaining these over-optimistic assumptions, Frye testified[217] that her team was "feeling pressure internally" to reduce costs so that Shen would appear more economically viable. She also testified that the assumed cost reductions were "*a big uncertainty.*"

> *Q This is a sensitivity that shows that with cost reductions, the PIR10 would be above .3 at $80 a barrel oil; correct?*
>
> *A I would preface it with we were feeling pressure internally to bring the valuation higher by reducing costs, and that is what this case is based on.*
>
> *Q If you were able to reduce costs in the sensitivity, then the PIR10 would be over .3 at $80 a barrel price; correct?*
>
> *A The imperative word in that sentence was "if." The reality is we did not know whether we would be able to reduce those costs.*
>
> *Q It remained an uncertainty?*
>
> *A If we could keep costs – if we could reduce costs was a big uncertainty, yes.*

260. In my expert opinion, this cost reduction exercise resulted in simply lowering cost assumptions without successfully identifying valid and tangible ways to reduce costs. In other

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[216] APC-00058541 dated 12/14/15.

[217] Lea Frye Deposition dated 10/7/22, page 193, line 25 to page 194, line 15.

words, the assumed cost reductions were not based on actual cost improvements, and even with them in place, Shen was not economic at $60/bbl.

L. Post-Shen-4: Asphaltene Test Results of Commingled Oils

261. Another major issue arose from the testing of commingled oil samples that seriously threatened the viability of commingled completions. AOP tests of commingled Shen oil samples yielded very negative results as communicated on October 21, 2015 by Fyfe with Corelab, who performed the tests. Oil samples from the LWC, LWD, and LWE zones were combined at initial pressure and temperature, and a substantial volume of asphaltene had already dropped out of solution above 19,500 psig. The constraint of having to maintain reservoir pressure above the single zone AOP was already recognized as crucial, and commingling production from multiple zones made asphaltene deposits an even worse threat to Shen's economic viability. Corelab's technician even apologized for delivering[218] the bad news.

> *Corelab: "I can tell you that we prepared the volumetric blend of the fluids in a cylinder as per your instructions and homogenized however upon charging the blend to the AOP unit the fluid was observed to have already flocculated asphaltene. We homogenized the fluids at 19,500 psig for about 12 hours in the unit prior to performing a pressure reduction study to confirm that the flocculation did occur above the charge pressure*."
>
> "*Either way I apologize for the bad news but hope that you can gain some information from the data generated*."

262. A subsequent email[219] on October 30, 2015 stated the volume of asphaltene dropout was unusually large by describing it as a "*fantastic amount of asphaltene*." The volume of the deposit matters because the more asphaltene that deposits from the oil causes the reservoir, production tubing, and tie back lines to plug more rapidly.

> *Corelab: "When we took the blending cylinder apart for cleaning there was a fantastic amount of asphaltene present in the top of the piston of the cylinder*."

263. Commingling the crude oil from three zones of Shen-2 caused the dropout pressure to rise by several thousand psi, greatly increasing the locations and conditions in which asphaltenes deposit and block flow. The unblended AOP was 11,700 psig for the LWC oil, 13,500 psig for the LWD oil, and 5,500 psig for the LWE oil, compared to the blended AOP of 19,500 psig.

264. With such a high AOP, the phenomenon of crossflow is likely to damage the reservoir when zones are commingled. When a well is shut in at the surface, crossflow occurs downhole when the formation pressures of zones open to the completion have separate pressure gradients, and the zone with the higher-pressure gradient flows into the lower pressure zone. Formation permeability can be damaged as fluid mixes in the formation and pressure eventually depletes below the AOP of 19,500 psig. Wells need to be shut in for various reasons, so the

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[218] APC-00052393 dated 10/21/15.

[219] APC-00053552 dated 10/30/15.

problem of crossflow cannot be avoided and will have a significant negative impact on commingled wells. Exhibit 61 shows that the LWC, LWD, and LWE sands follow separate pressure trends in Shen-1, -2 and -4ST1, so crossflow is likely to occur in all three wells at shut in conditions.

265. Commingled completions were essential to the economic viability of the Shen field by reducing the number of production wells. If each of the eight zones in each fault block required a separate completion, the well count would need to increase by nearly an order of magnitude, and at $200-300 MM/well, drilling and completion costs would be prohibitive. Some zones could be produced sequentially, but revenue from production would be delayed and recompletion costs would rise substantially. Frye addresses these issues in her testimony on the high AOP of the commingled oils as follows:[220]

> [BY MS. JENSEN:]
> *Q Did these results impale the viability of commingled production?*
>
> THE WITNESS: *Yes, it did impair the potential to commingle in any one wellbore.*
>
> [BY MS. JENSEN:]
> *Q Could you elaborate on what that means?*
>
> *A When you commingle in a wellbore, you would take multiple zones and complete them and then allow those to flow together within that wellbore and produce it to the surface rather than doing one zone by itself.*
>
> *And those fluids would mix in that wellbore as they came together.*
>
> *Q Would isolating each zone for production have a negative impact on Shenandoah's economics?*
>
> THE WITNESS: *Yes, isolating individual zones would have a significant impact by one of two factors. One way to handle it would be drill individual wells for every zone and there was significant number of zones.*
>
> *I would have to have a document in front of me to remind me exactly how many zones, but I want to say we had the upper Wilcox 1, 2 and 3 and I want to say it was a lower Wilcox A, B, C, D and E, which would be eight. I would have to verify that with a document, but that's my recollection on the zones.*
>
> *And drilling eight individual wells would not work for every single drainage area across the field.*
>
> *The other option you would have would be to compete each individual zone and produce it to the end of life and how that negatively will impact your economics is now you are getting production at a lower rate because you have one zone versus*

[220] Frye Deposition 10/12/22, page 63, line 20 to page 65, line 15 (objections omitted).

having more than one zone together and it takes a really long time to get that production.

So that impacts your net present value by discounting that value of production over a really long time.

BY MS. JENSEN:
Q *Was this issue discussed with management?*

A *Yes.*

M. Post-Shen-4: Cost and Economic Impact of Asphaltene Deposition

266. At flowing conditions, asphaltene deposits were expected to occur in the downhole production tubing starting at initial conditions[221] through to depletion. With such high initial pressures (>23,000 psig), the Shen wells would flow to the surface without artificial lift for many years. As the production rises up the production tubing, both pressure and temperature decrease, inevitably reaching the AOP in all wells. Pressure decreases as the fluid rises because less fluid lies above to support. Fluid temperature decreases because the earth's temperature cools at shallower depths. The AOP increases substantially at cooler temperatures, so cooling of produced fluid worsens asphaltene deposition. For example, the AOP measured in oil from the LWA zone in Shen-2 increased from 10,900-11,500 psig[222] at 202°F to 19,500 psig[223] at 135°F. Hence, asphaltene deposition will occur at some depth downhole starting at first production in all wells. Asphaltene dropout in the production tubing is confirmed in an analysis[224] by Anadarko presented on 6/25/15 quoted as follows: "***Asphaltene deposit expected at ~11,000 ft. below mudline from day 1 of production.***"

267. The primary remedial action available for restoring declining well performance from asphaltene deposition is coiled tubing cleanouts in which the asphaltene deposit is mechanically removed from inside the tubing and circulated out of the well.

268. The assumed total cost of these cleanouts is a function of the cost per cleanout intervention, the frequency of cleanouts, and the duration until the first cleanout is required. During the two months of December 2015 and January 2016, the assumed cost per cleanout ranged from $7 MM[225] all the way up to $60 MM,[226] which in my expert opinion is an inexplicably wide range

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[221] APC-01701959 dated 12/10/15, page 8.

[222] APC-00233134 dated 3/22/16, page 36.

[223] APC-01701959 dated 12/10/15, page 8.

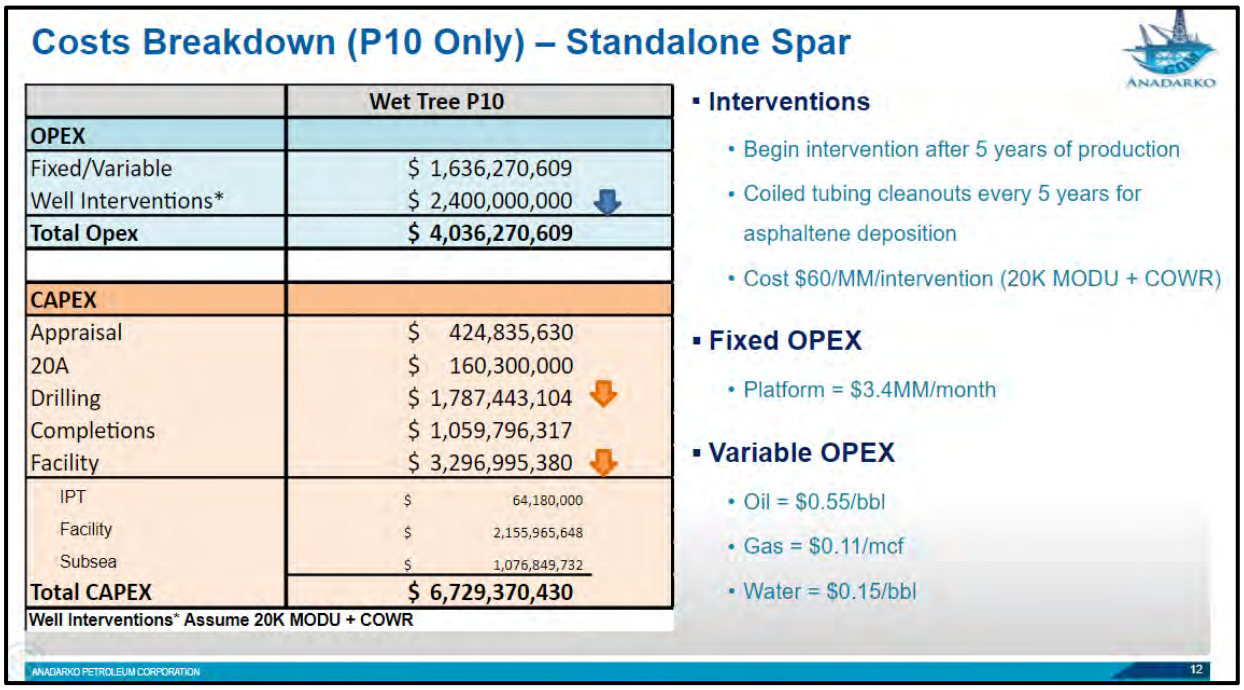
[224] APC-00041056 dated 6/25/15, page 9. Also shared with partners in APC-00058397 dated 12/27/15.

[225] APC-00222654 dated 1/27/16.

[226] APC-00056772 dated 12/9/15.

and not credible. The frequency of cleanouts ranged from once every two years[227] to every five years[228] and longer.

269. The negative economics presented in Exhibit 65 were based on a total intervention cost of $2.4 billion over the life of the field to remove asphaltene deposits in the wellbore, making it the second largest cost category behind facility costs. Exhibit 66 details[229] the cost categories of this evaluation and provides some of the key assumptions, such as five years to first intervention, one intervention every five years and $60 MM/intervention.



Costs Breakdown (P10 Only) – Standalone Spar

ANADARKO

	Wet Tree P10
OPEX	
Fixed/Variable	$ 1,636,270,609
Well Interventions*	$ 2,400,000,000
Total Opex	**$ 4,036,270,609**
CAPEX	
Appraisal	$ 424,835,630
20A	$ 160,300,000
Drilling	$ 1,787,443,104
Completions	$ 1,059,796,317
Facility	$ 3,296,995,380
IPT	$ 64,180,000
Facility	$ 2,155,965,648
Subsea	$ 1,076,849,732
Total CAPEX	**$ 6,729,370,430**

Well Interventions* Assume 20K MODU + COWR

- **Interventions**
  - Begin intervention after 5 years of production
  - Coiled tubing cleanouts every 5 years for asphaltene deposition
  - Cost $60/MM/intervention (20K MODU + COWR)
- **Fixed OPEX**
  - Platform = $3.4MM/month
- **Variable OPEX**
  - Oil = $0.55/bbl
  - Gas = $0.11/mcf
  - Water = $0.15/bbl

ANADARKO PETROLEUM CORPORATION 12

Exhibit 66: Costs Breakdown (P10 Only) – Standalone Spar

270. The same presentation provided a list of economic drivers of value, shown in Exhibit 67,[230] in which intervention frequency was identified as the single most important uncertainty impacting both upside and downside value. Following this evaluation, assumptions for intervention frequency and costs varied widely with extraordinarily large improvements unaccompanied by any technical explanation for the basis of the improvement.

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227 APC-00056772 dated 12/9/15.

228 APC-00222654 dated 1/27/16.

229 APC-01702168 dated 1/5/16, page 11.

230 Same.

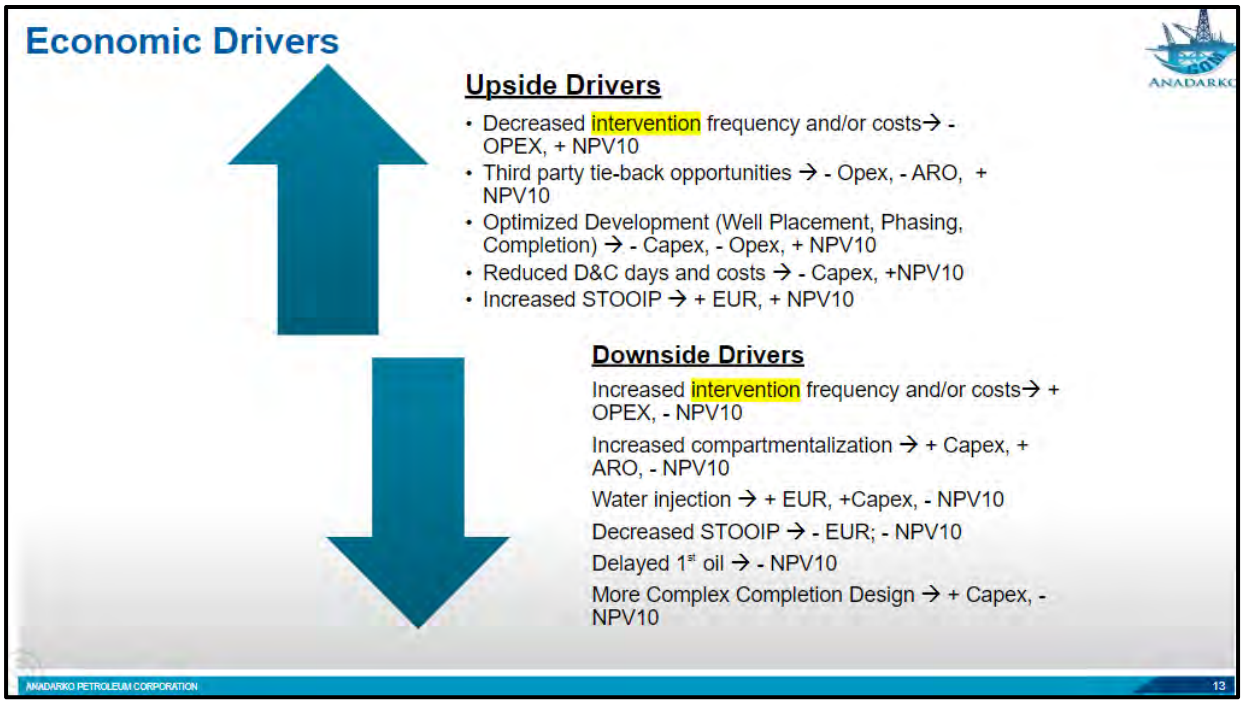

Exhibit 67: Economic Drivers

271. Exhibit 67 provides evidence that these results were based on very biased and optimistic assumptions. Increased compartmentalization was listed as the second most important driver of downside loss but was not even mentioned in the list of upside drivers of value. This imbalance of significant downside but no upside risk and uncertainty demonstrated that the base case had no upside with respect to compartmentalization and plenty of downside. In my experience as a manager of economic evaluations, this lack of balance fails the simple test of whether a key assumption has a comparable amount of upside as downside. In my expert opinion, this economic evaluation showing negative results failed to capture just how negative the risked economics of the Shen field were.

272. The assumed frequency of tubing cleanout for the more expensive intervention cost of $2.4 billion was once per five years as shown in Exhibit 66. An Anadarko presentation on asphaltene mitigation was sent to partners on April 5, 2016 with an estimate for the rate of asphaltene deposition:[231] "*Asphaltene deposition at the rate of ~2 bbl /~20,000 bbl of oil flow*" *(emphasis added)*. At this rate of deposition, a well producing 5,000 BOPD for five years would yield 912 bbls of asphaltene deposits. An oilfield barrel is 5.6 ft.^{3}, so that volume would equate to 5,100 ft.,^{3} ***enough asphaltene deposits to fill 9 miles of production tubing*** with an inside diameter of 4.5 inches. At an initial rate of 15,000 BOPD, a well could produce enough asphaltene deposits to fill a mile of production tubing in less than 70 days. Only a few hundred feet of blockage would require a cleanout intervention, so blockage could occur in days, weeks or months, with a small chance of producing trouble-free for five years. In my expert opinion, this asphaltene deposition rate was a major threat to the viability of a Shen development and the assumption of five years between needing cleanout was extremely optimistic.

[231] APC-00236819 dated 4/5/16 attached to email APC-00236818 stating purpose for partners.

273. Another factor negatively impacting economics is well downtime from asphaltene deposits plugging the production tubing and flowlines. As stated in paragraph 265, asphaltene deposition will occur downhole in Shen producers from the day of first production. This deposition will plug the tubing and cause oil rates to drop, resulting in substantial delays and losses in production. Mobilizing a rig to perform the tubing cleanout can take months, resulting in additional downtime. In my expert opinion, the assumption of 90-95% uptime[232] for wells to produce at their assumed rates is unrealistically optimistic given the volume of asphaltene deposits discussed in the previous paragraph. This case also assumes no degradation in well performance due to deposition in the reservoir, which is very optimistic given the complex faulting observed in Shen-4.

N. Post Shen-4BP1 and Reconciliation

274. Johnson wrote an email[233] to Pachman regarding overwhelming evidence of structural complexity. In my expert opinion, this structural complexity was ignored in Exploration's evaluation of the uncertainty on the eastern side of the structure and assuming pressure continuity between Shen-4ST1 and Shen-3.

> *"The data we already have along with the new paly data and interpretation, the Chemostrat data we received earlier in the week, and the possible presence of a fault at the base of the current bypass core well (missing LWE into Cretacesous at TD) are* ***overwhelming evidence of structural complexity*** *that I think will be better understood by drilling the SW sidetrack." (Emphasis added.)*

275. The following email[234] update by Johnson on the bypass core wellbore provides insight into the extraordinary complexity of faulting at the Shen field. The bypass core (Shen-4BP1) was 300-400 ft. from the Shen-4ST1 wellbore, yet the UW2, LWE, and LWF sands were missing in the bypass, and the MDT pressures indicated a lack of pressure continuity over just 300-400 ft. With sands disappearing and pressure isolation occurring over 300-400 ft., Exploration's assertion that the higher pressures measured in the Shen-4 LWC and LWE zones were in communication with Shen-3 located over 15,000 ft. and established deeper OWCs in this area lacks any credibility.

> *"The bypass (BP) core kicked off at 28,098' MD and TD @ 31,765' MD in the Cretaceous. Paleo data confirmed Cretaceous starting at ~31,590' MD with carbonate lithologies starting at 31,525' MD and persisting to TD. The well averaged ~300'-400' of separation from the ST01 wellbore throughout the Wilcox section (~350' N-NW at TD).* ***The top sand (interpreted as UW2) and the LWE & LWF sands in the ST01 well were missing in the BP well. Pressures from the LWA & LWB sands in the BP well were 10 & 25 PSI higher respectively for equivalent sands in the ST01 well implying pressure compartmentalization between the BP and ST wells****." (Emphasis added.)*

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[232] APC-00058253 dated 12/17/15, page 3.

[233] APC-00057599 dated 12/11/15.

[234] APC-00057719 dated 12/14/15.

276. Partner alignment had deteriorated substantially after the bypass core in Shen-4. COP, Marathon and Cobalt had declared non-consent, leaving Anadarko at a 90% working interest drilling Shen-4ST2. Given the drilling difficulties encountering tar, capital constraints and lack of partner participation, Anadarko abandoned the sidetrack. Daniels updated[235] Walker in the following email:

> *"Wanted you to be aware that Cobalt went non-consent on a new sidetrack at Shenandoah, said they did not have the budget for it. They like the location but given the failed first try and the technical difficulties could not get the budget approved. We discussed internally whether to continue at 90% WI and decided with the drilling difficulties and the capital squeeze the best thing at this point is to P&A with the option of re-entering the well at a later date. Let me know if you have any questions or concerns. Thanks. Bob." (Emphasis added.)*

277. On January 5, 2016, McGrievy[236] clarified that the Development team was then responsible for evaluating the Shen project and called a meeting to resolve the significant differences between the two groups, announced to his staff

> *"All:*
>
> *Since the development team will be assuming the responsibility for the Shenandoah portfolio modeling in 2016, I would like to hold a review (for the benefit of both teams) to understand the key differences between the current exploration and development economic models and potentially reconcile the differences. Additionally, the Shenandoah #5 AFE will be circulating within the next two-three weeks and we need to be on the same page or at least understand the assumptions and economics prior to circulation of this AFE.*
>
> *Thanks, Pat" (Emphasis added.)*

278. McGrievy followed up with an email[237] outlining his priorities for the meeting to reconcile the major differences between Exploration's and Development's evaluations. His main priority was to focus on the P90 area. He also doubted the assumption of widespread pressure continuity allowing Shen-3 aquifer pressures to determine the depth of the OWC. Finally, he warned that the CEO would be confronted with more negative resource volumes and economics from the Development team than the Exploration team. Key sentences from this email are as follows:

> *"By virtue of their portfolio model, Exploration continues to maintain that the east side is essentially risk free and that their P90 represents a limit identified by the MDT data and an extrapolated OWC from the Shen 3 which is highly subjective."*

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235 APC-00219588 dated 1/6/16.

236 APC-00660240 dated 1/5/16.

237 APC-00059603 dated 1/10/16.

> *"The big needle mover will be the defense of the P90 area and that's where the major portion of this discussion should focus."*
>
> *"I think you all are aware that there will be a big issue when Walker sees the economics of this Afe, as we will show a major drop in the value of this project." (Emphasis added.)*

279. Before the RCT meeting to reconcile differences between Exploration and Development, Camden wrote[238] the following to Strickling about his work with Kendall on identifying key differences between the two groups, especially pertaining to the potential range in the area.

> *"Also, Beth and I worked on trying to figure out the logic (or lack thereof) for their P90 area, and what we will argue for in the RCT review Monday. Their P99 area is only 400 acres, and we have 3 penetrations that have found 100's to 1000's of feet of pay. We think the P99 area should be more like 1200 acres (3 wells times 400 ac/well)." (Emphasis added.)*

280. The P99 estimate for the eventual area of the oil accumulation should represent the smallest outcome possible, which should have included the downside of a heavily compartmentalized scenario based on how much evidence Shen-4 provided regarding faulting. In my expert opinion, 400 acres per well is far too large of a drainage area per well for estimating the P99 heavily-faulted, minimum outcome.

281. The internal audit function of the Risk Consistency Team ("RCT") facilitated an effort to resolve the differences between the two groups in a meeting on January 11, 2016, the result of which was to model the east and west sides of the field with separate one-layer MMRA files[239] and combine the two with a multizone model[240] that included a risk factor of 75% chance of success applied to the eastern side. Frye wrote an email[241] describing the meeting as coming to an agreement, but that Exploration felt the low side was too low, and the Development team still believes the low side is too high with the agreed version referred to as the "Joint Model." Exhibit 68 compares key assumptions in the Joint Model to the previous evaluations for both teams.

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[238] APC-00663017 dated 1/8/16.

[239] APC-01702213 dated 1/12/16 for the west block, and APC-01702208 dated 1/12/16 for the east block.

[240] APC-01702214 dated 1/13/16.

[241] APC-00663563 dated 1/13/16.

		Post Shen-4ST1		1/11/16 Meeting	
		Development	Exploration	Joint Model	
Block Areas		Combined	Combined	West Block	East Block
Risk		100%	100%	100%	75%
Area, Acres	P90	800	1,723*	1,006	983
	P10	3,000	2,680*	1,521	1628
Net Pay, ft	P90	500	1,010**	611	611
	P10	1,000	1,339**	1,000	1000
Recovery Factor	P90	13.8%	20%	13.8%	13.8%
	P10	30.8%	30-35%	30%	30%
Resource, MMBOE	P90	100	635	185	
	Mean	304	755	426	
	P10	607	883	694	
** average of P90 values and P10 values for area*					
*** sum of all P90 and P10 net pay values*					

Exhibit 68: Joint Model Resource Estimate Compared with Prior Evaluations (1/11/16)

282. The mean recoverable resource volume totaled 426 MMBOE, a 44% reduction from Exploration's previous estimate for the mean, with a downside P90 value of 185 MMBOE, a 71% reduction from Exploration's previous estimate for P90. The upside P10 value of 694 MMBOE was similar to Exploration's previous P90 estimate. For the Development team, the Joint Model represented an increase in the mean of 40%.

283. The P90 areas in the joint model were actually increased when considering the sum of the P90 areas for both blocks, totaling 1,989 acres, compared to 800 acres assumed by Development and an average P90 area of 1,723 acres assumed by Exploration. The Exploration team agreed to a substantially lowered P90 net pay, reflecting some recognition of the observed crestal thinning. Exploration also appeared to agree to a lower P90 recovery factor of 13.8%.

284. Exhibit 69[242] provides a historical summary of the estimated resource post-Shen-1, post-Shen-2, post-Shen-3, post-Shen-4, and post-reconciliation prepared on January 12, 2016. From 2013 to the end of 2015, Exploration consistently represented the P99 absolute low end as being larger than 500 MMBOE. The Joint Model represented substantially more downside risk with a P99 recoverable volume of only 91 MMBOE. I have not been able to find files supporting the calculation of the complex trap method.

[242] APC-01165123 dated 1/13/16.

Shenandoah Reserves	Geologic Reserves				
	P99	P90	Mean	P10	P1
Multi Zone Method	91	185	426	694	1047
Complex Trap Method	68	141	353	671	1115
Development (4Q 2015)	45	100	304	609	1177
Post-Drill Shenandoah #4	563	635	755	883	993
Post-Drill Shen #3 & Yuc #2	703	781	917	1060	1177
Post-Drill Shenandoah #2	830	952	1197	1469	1700
Post-Drill Shenandoah #1	56	82	143	219	382
Pre-Drill Shenandoah #1	10	22	107	235	513
Initial Farm-in	10	22	85	180	362

Exhibit 69: Historical Progression of Resource Estimates (1/13/16)

285. The agreement between Exploration and Development did not last long. The January 20, 2016 GOM Exploration Engineering Activity Report[243] had the comment under Shen-4 as follows: "*Team is building a revised MMRA to reflect a P99 case based on Exploration interpretation" (emphasis added).* A pair of revised Exploration resource evaluations were shown in Exhibit 70 on January 26, 2016[244] as follows:

[243] APC-00665029 dated 1/20/16.

[244] APC-01351361 dated 1/26/16, page 9.

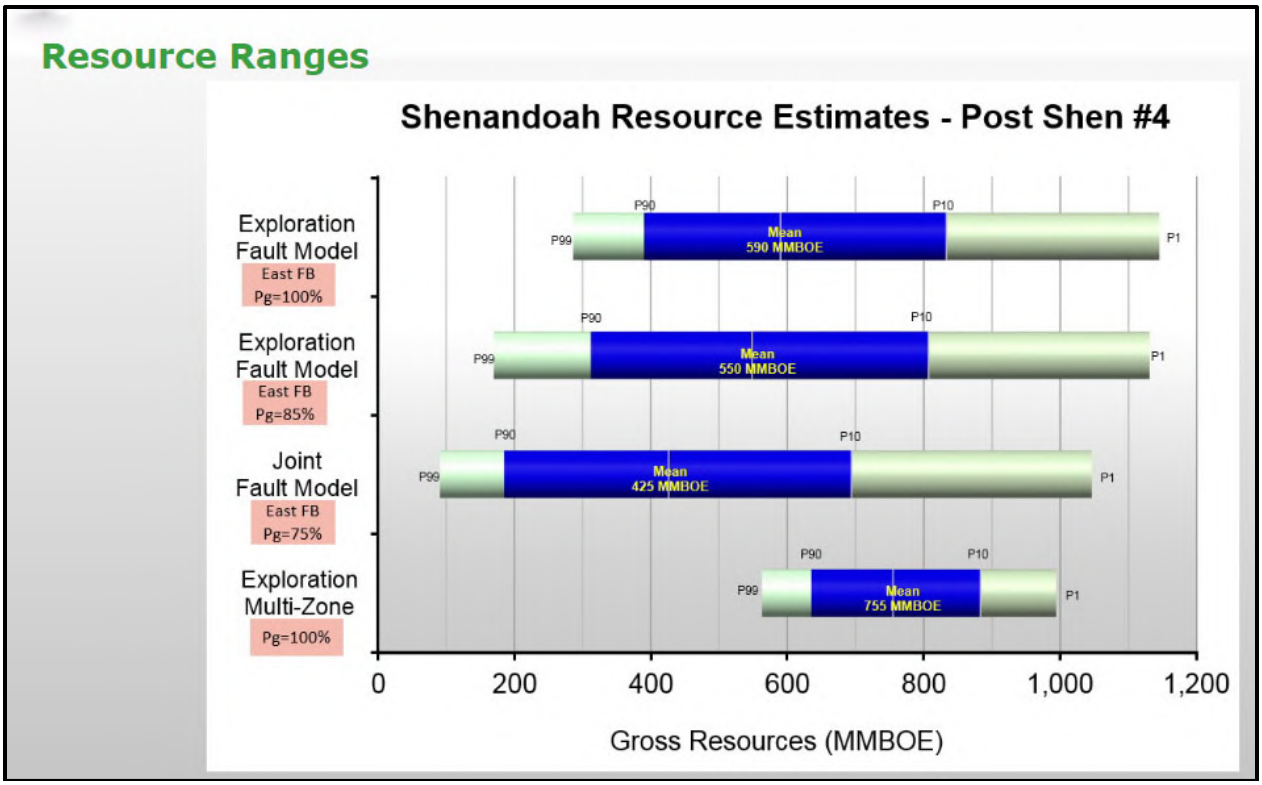

Exhibit 70: Exploration's Updated Resource Estimates (1/26/16)

286. Two new Exploration fault model cases were presented, one with a mean of 550 MMBOE and the other with a mean of 590 MMBOE. Exhibit 71 below shows key assumptions in these calculations obtained from MMRA and Multizone models.[245]

[245] West block modeled in APC-01166061 dated 1/21/16 MMRA file; east block modeled in APC-01166062 and combined in Multizone model APC-01702256 dated 1/22/16.

		Post Shen-4ST1		1/11/16 Meeting		Exploration's	
		Development	Exploration	Joint Model		Model 1/22/16	
Block Areas		Combined	Combined	West Block	East Block	West Block	East Block
Risk		100%	100%	100%	75%	100%	85%
Area, Acres	P90	800	1,723*	1,006	983	1,129	738
	P10	3,000	2,680*	1,521	1628	1,521	1521
Net Pay, ft	P90	500	1,010**	611	611	790	790
	P10	1,000	1,339**	1,000	1000	1,063	1,063
Recovery Factor	P90	13.8%	20%	13.8%	13.8%	17.7%	17.7%
	P10	30.8%	30-35%	30%	30%	32%	32%
Resource, MMBOE	P90	100	635	185		312	
	Mean	304	755	426		548	
	P10	607	883	694		807	
** average of P90 values and P10 values for area*							
*** sum of all P90 and P10 net pay values*							

Exhibit 71: Exploration's Updated Resource Estimates (1/21/16)

287. Compared to the joint model, Exploration assumed a higher chance of success in the eastern block of 85% versus 75%, a somewhat lower P90 area for the eastern block, a higher value for P90 net pay of 790 ft. versus 611 ft., and a substantial increase in P90 recovery factor of 17.7%, up from 13.8%. The resulting mean increased 29% from 426 MMBOE to 548 MMBOE, rounded to 550 MMBOE.

288. Exhibit 71 also shows a version with a mean of 590 MMBOE carrying no chance of failure in the eastern block. No Multizone file was found to contain the 590 MMBOE result, but the result was replicated by simply changing the eastern block chance factor from 0.85 to 1.0 and re-running the Monte Carlo simulation.[246]

289. A presentation on January 21, 2016 titled "Shenandoah 5, WR 51 #4 Appraisal Well Proposal"[247] for Kleckner provides an economic evaluation based on the joint model resource geologic distribution (untruncated mean of 426 MMBOE). These economics were also presented to the EC[248] on February 1, 2016 as part of the Shen-5 AFE approval process. The Multizone model result, shown in Exhibit 72 below,[249] also provides a distribution truncated below a commercial cutoff of 200 MMBOE. The range of economic outcomes was combined in a probability-weighted decision tree with four branches, appraisal failure (<200 MMBOE), a P90 case (263 MMBOE, a P50 case (434 MMBOE), and a P10 case (717 MMBOE).

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246 APC-01702256 dated 1/22/16.

247 APC-01166104 dated 1/21/16, page 17 for resource, and pages 29 and 34 for decision tree.

248 APC-01167170 dated 2/1/16, filename "Shen5_approval_ review_EC_final.pptx."

249 APC-01166104 dated 1/21/16, page 17.

Joint Resource Estimates (Pre Drill Shen 5)

	Un-Truncated Resources			Truncated Resources		
Recoverable Resource	Prospect Aggregate Geologic			Prospect Aggregate Commercial		
Thresholds	Zone and Prospect level thresholds NEVER applied.			Zone Thresholds disabled. Prospect Threshold applied (167 MMBO / 200 BCF)		
Product	Liquids	Gas	Equivalent	Liquids	Gas	Equivalent
Units	MMBO	BCF	MMBOE	MMBO	BCF	MMBOE
P99	75.955	90.244	90.996	173.506	204.656	207.618
P90	154.764	182.451	185.174	220.041	259.194	263.249
Mode	266.331	312.598	318.345	264.686	310.755	316.433
P50	340.220	400.443	406.948	362.517	426.457	433.584
Mean (P99->P01)*	356.635	418.990	426.467	385.685	453.015	461.188
P10	580.335	679.648	693.582	599.641	701.484	716.549
P01	876.075	1,022.584	1,046.506	891.432	1,040.218	1,064.798
Chance	NA	NA	100.0%	NA	NA	88.2%

Exhibit 72: Joint Model Resource Estimate (1/21/16)

290. The economic evaluation results[250] are summarized in Exhibit 73, with the risked mean representing the chance-weighted result of four branches of the decision tree. At a $60/bbl price, the net after-tax net present value was $208 MM with a PIR10 of 0.22, less than Anadarko's corporate threshold. These economics assumed that aquifer support was sufficient to avoid asphaltene dropout and that no injection wells were required. In my expert opinion, this was a very optimistic assumption given the evidence from Shen-4 that proved compartmentalization on an extraordinarily small scale. This evaluation substantially overstated the project's economic potential by excluding the impact of compartmentalization on production, pressure maintenance, need for injectors, EUR/well, recovery efficiency, and asphaltene dropout in the reservoir, production tubing and flowlines.

Economic Summary (APC WI = 30%)

Risked / Un-risked Mean Stand-alone (2016 forward)

	Invest $60/bbl			Upside $80/bbl				
	Net AT NPV10 ($MM)	AT PIR10	F&D ($/BOE)	Net AT NPV10 ($MM)	AT PIR10	F&D* ($/BOE)	Mean Gross EUR (MMBOE)	P_c
Risked Mean	208	0.22	15.38	478	0.48	16.07	412.6	88.2%
Unrisked Mean	250	0.24	15.18	557	0.50	15.87	468.0	100%

*Increased facilities costs at $80 oil (market driven)

Exhibit 73: Economics for Shen-5 Economics Based on Joint Model Resource Estimate (1/21/16)

291. These economics, which were prepared for the Shen-5 AFE approval review (based on filename "Shen5_approval_ review_01192116_final_Kleckner.pptx"), improved substantially over the uneconomic December 17, 2015 results provided in Exhibit 65, but the improved economics still failed to meet the 0.3 PIR10 corporate threshold referred to in Hollek's

[250] Same, page 36.

deposition.[251] Part of the improvement resulted from the 40% increase in the Development's mean resource size from 304 MMBOE to 426 MMBOE that followed from the reconciliation meeting on January 11, 2016 discussed in the previous section. The cost reduction initiative discussed in Paragraph 255-259 resulted in a very substantial $1.6 billion reduction in the assumed costs of asphaltene clean out interventions, and a $110 MM/well reduction in drilling and completion costs. Exhibit 74 compares key cost assumptions[252] between the December 17, 2015 and January 21, 2016 evaluations.

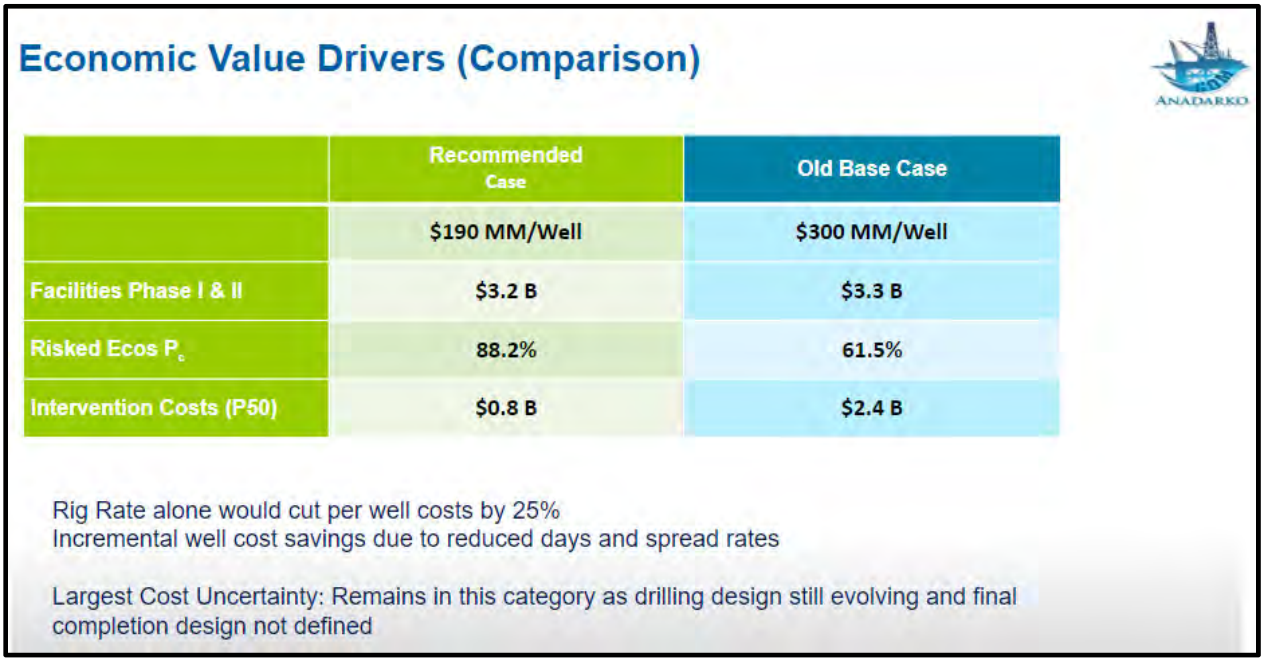

Exhibit 74: Economic Value Drivers (Comparison)

292. The cost reduction in asphaltene cleanouts resulted primarily from decreasing the assumption[253] for intervention cost from $60 MM/cleanout to just $7 MM/cleanout. This case also included a 10-year delay before the first cleanout, which is overly optimistic considering the asphaltene deposition rate discussed in paragraph 271. I was unable to find an explanation for such an extraordinary cost reduction. In my expert opinion, this reduction appears to be the result of management direction and not based on sound engineering work.

293. On the following day, in fact, the Development team finalized an economic analysis comparing development with wet vs. dry tree completions[254] for distribution to partners. Exhibit

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[251] Darrell Hollek Deposition dated 9/1/22, page 53, lines 11-25.

[252] APC-01702234 dated 1/19/16, page 27 of filename "Shen5_approval_review_01192016_final.pptx."

[253] APC-00222654 dated 1/27/16, tab "P50_production_Opex" and "lt 28 Updated Intervention

[254] Wet tree = subsea wellhead tied to surface facilities via flowline and umbilicals; dry tree = wellhead above the water level on the surface facility.

75 compares the cost estimates[255] for the two cases, with intervention costs totaling $2.7 billion for the wet tree scenario. On January 20, 2016, intervention costs, also for a wet-tree development, totaled $0.8 billion over the life of the project, and on January 21, 2016, these same costs were estimated to total $2.7 billion, a difference of $1.9 billion.

	Dry Tree	Wet Tree
OPEX		
Fixed/Variable/PHA Fees	$ 4,725,470,086	$ 2,245,560,675
Well Interventions*	$ 2,092,500,000	$ 2,740,500,000
Total Opex	**$ 6,817,970,086**	**$ 4,986,060,675**
CAPEX		
Drilling	$ 1,135,707,400	$ 1,232,895,200
Completions	$ 394,748,000	$ 966,241,200
Facility	$ 2,891,264,100	$ 3,276,431,824
Total CAPEX	**$ 4,421,719,500**	**$ 5,475,568,224**
Total	**$ 11,239,689,586**	**$ 10,461,628,899**
Upfront Capital	$ 3,933,660,208	$ 3,881,392,080

Exhibit 75: Dry Tree vs. Wet Tree

294. The economic comparison of wet vs. dry completions essentially hinged on intervention costs from asphaltene deposition. Wet tree completions are substantially more expensive to workover, given their location more than one mile below the water surface. If interventions are few, wet tree completions might be more economical, but if asphaltene issues are numerous and recurrent, then dry trees would be less costly. In my expert opinion, the wet tree vs. dry tree evaluation required a realistic assessment of intervention costs to make the right decision on which development concept to pursue. The January 20, 2016 Shen-5 AFE evaluation may have been more subject to senior management's pressure to reduce cost assumptions.

295. Intervention costs had been flagged as the most important driver of value the month before as shown in Exhibit 67, yet Anadarko simultaneously maintained two extraordinarily different cost assumptions that varied by a multiple of 3.4. Both economic evaluations were for important decisions, and in my expert opinion, there is no apparent reason for maintaining such widely different cost assumptions for economic evaluations.

296. A week after Exploration revised its resource evaluation upward, ignoring the RCT downward adjustment, the Development team's reaction was likely expressed in the following quote from an email[256] from Chandler to Oudin sent on January 28, 2016:

"Subject: RE: Enjoy . . . 2016 updated resources

[255] APC-00060752 dated 1/21/16, file name "Dry_Tree_Economics_Concept_Select_Partners_FINALCOPY.docx. Attached to email APC-00060751 links to partners.

[256] APC-00666725 dated 1/28/16.

> *Yeah, this is just pure politics. If this stands it's just makes a mockery of our previous meeting with those guys to construct a "joint" MMRA resource distribution. So . . . when do you think they were planning on telling us about this??" (Emphasis added.)*

297. McGrievy wrote to David Janise, Manager of Planning for the Gulf of Mexico, about the transition of Shen from Exploration to Development, and his concern that Exploration was much more aggressive in their resource assessment and economics, requiring McGrievy to walk "*on egg shells.*"[257]

> *"I presume that it is now been fully transitioned to our shop. We had a Shen 5 review yesterday with Daniels and Kleckner and again I'm hopeful that this was the passing of the torch. Bob D. didn't appear to have any problems with our take on reserves. We will be running economics based on guidance below and will meet show to Tedesco and Abendschein for endorsement. The real issue will be the portfolio modeling as they were much more aggressive. Walking on egg shells is hard on the feet." (Emphasis added.)*

298. Camden updated Exploration's overly optimistic version of the economics[258] on February 9, 2016 in the following slide showing a mean resource size of 550 MMBOE post-Shen-4, down 40% from the pre-Shen-4 volume of 920 MMBOE. At $60/bbl, the after-tax net present value discounted at 10% was $675 MM, more than triple the value shown in the Development case in Exhibit 73 above. The discounted profit to investment ratio of 0.70 was also more than three times higher than Development's result of 0.22, signifying a much more optimistic representation by Exploration.

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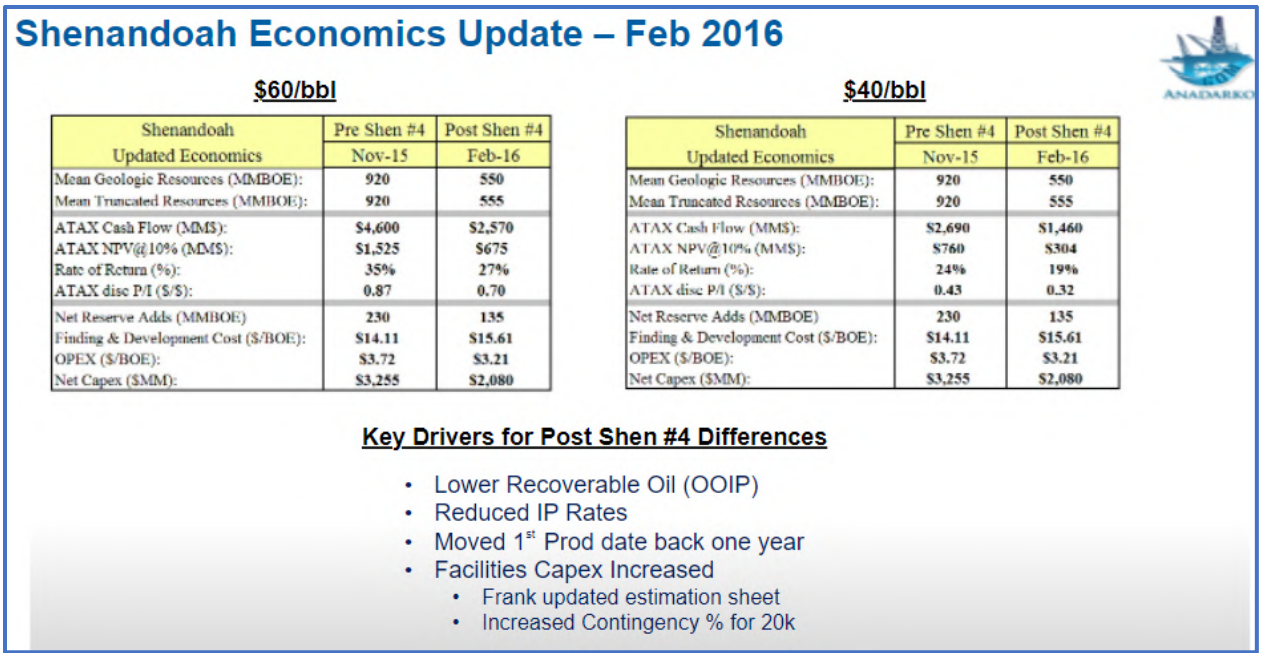
[257] APC-00665185 dated 1/22/15.

[258] APC-00225661 dated 2/9/16.



Shenandoah Economics Update – Feb 2016

$60/bbl

Shenandoah Updated Economics	Pre Shen #4 Nov-15	Post Shen #4 Feb-16
Mean Geologic Resources (MMBOE):	920	550
Mean Truncated Resources (MMBOE):	920	555
ATAX Cash Flow (MM$):	$4,600	$2,570
ATAX NPV@10% (MM$):	$1,525	$675
Rate of Return (%):	35%	27%
ATAX disc P/I ($/$):	0.87	0.70
Net Reserve Adds (MMBOE)	230	135
Finding & Development Cost ($/BOE):	$14.11	$15.61
OPEX ($/BOE):	$3.72	$3.21
Net Capex ($MM):	$3,255	$2,080

$40/bbl

Shenandoah Updated Economics	Pre Shen #4 Nov-15	Post Shen #4 Feb-16
Mean Geologic Resources (MMBOE):	920	550
Mean Truncated Resources (MMBOE):	920	555
ATAX Cash Flow (MM$):	$2,690	$1,460
ATAX NPV@10% (MM$):	$760	$304
Rate of Return (%):	24%	19%
ATAX disc P/I ($/$):	0.43	0.32
Net Reserve Adds (MMBOE)	230	135
Finding & Development Cost ($/BOE):	$14.11	$15.61
OPEX ($/BOE):	$3.72	$3.21
Net Capex ($MM):	$3,255	$2,080

Key Drivers for Post Shen #4 Differences

- Lower Recoverable Oil (OOIP)
- Reduced IP Rates
- Moved 1st Prod date back one year
- Facilities Capex Increased
  - Frank updated estimation sheet
  - Increased Contingency % for 20k

Exhibit 76: Exploration's Economics Pre and Post Shen-4 (2/9/16)

O. Shenandoah's Viability Was in Serious Doubt at Least by December 2015

299. In my expert opinion, Shen was uneconomic venture following the negative results from Shen-4 according to Anadarko's corporate threshold, and Anadarko senior management shared this view according to several internal documents. Shen's economic viability was in serious doubt by December 2015 and persisted into 2017. The economics presented on December 17, 2015 showed negative returns, despite multiple optimistic assumptions as discussed in paragraphs 254. The following paragraphs show documents that establish Anadarko senior management negative view after Shen-4 and persisting up to condemning results from Shen-6.

300. On February 1, 2016, McGrievy emailed[259] a presentation to Kleckner that addressed strategic options going forward with the Shen appraisal program. Issues identified in Exhibit 77 included remaining resource uncertainty, more appraisal wells required, the 180-day drilling clock, partner alignment, new technology development required for high pressures, and an unfavorable seller's market given COP's unsuccessful sales effort.

[259] APC-00223103 dated 2/1/16 with attached pptx file APC-00223104.

Exhibit 77: Mention of Unfavorable Seller's Market for Shenandoah

301. Strategic options under consideration were listed as follows, ranging from "*continuing as is*" to exiting.[260]

"Strategic Opportunities Appraisal Operations:

Option #1: Maintain WI and progress to FID

Option #2: Evaluate tie-back/joint development opportunities prior to FID

Option #3: Explore other funding options to lower capital exposure prior to FID

Option #4: Exit" (Emphasis added.)

302. A file[261] titled "WSJ GOM talking points 12-2-15 RGG.docx" was sent to Walker apparently in preparation for an interview with the Wall Street Journal. Under a section labeled "Topics to Avoid," the third listed item to avoid was "*Shenandoah Complexities*," *(emphasis added)*, which is important to the discussion later in this report on material omissions.

303. On February 5, 2016, Walker expressed reluctance to proceed with further appraising the Shen field. Regarding a request[262] for a plane to fly to Finland to work on Shen facilities cost estimates, Walker raised the following question with Kleckner:

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[260] Changed to "Divest" in APC-01180900 dated 3/30/16, file named "Shen5_approval_review_EC_final .pptx."

[261] APC-00213515 dated 12/3/15, page 3, attached to email APC-00213514.

[262] APC-00668983 dated 2/5/16.

> *"So why are we looking at this type of trip at this time given our* ***recent discussions about not wanting to take this to development with a production solution as operator?*** *Thx, let me know as time permits. . ." (Emphasis added.)*

304. The significantly less attractive economics following Shen-4 likely impacted senior management's enthusiasm. Kleckner responded to Walker with the comment below that a better assessment of fabrication costs could enhance value in "*an exit or sell down/promote case" (emphasis added)* quoted below.[263] With options such as exit, sell-down, or promote, senior management investigated ways to reduce their exposure to risks of proceeding with the development of the Shen field, especially after the complex results from Shen-4.

> Kleckner to Walker: *"This team is trying to get a yard assessment to complete the scoping exercise. In an exit or sell-down/promote case, our value can be enhanced with valid solutions and estimates for development cost." (Emphasis added.)*

305. Walker responded[264] to Kleckner that he did not want to proceed with the facilities trip to Finland because a Shen sanctioning decision was years away based on recent results from Shen-4 and its sidetracks. He saw no way Anadarko would want to proceed with a Shen development.

> *"Jim . . . I am going to ask that we not do this. We are several years away from this type of decision based on what you showed us recently ... and I see no way we will want to take this to development today with a production solution.*
>
> *Should #5 drill out successfully and we need to reconsider this, I am open to that but this seems like an unneeded trip at this time to me." (Emphasis added.)*

306. Other indicators established low market value and that partners were heading to the exit door. On March 31, 2016, the sale of Marathon's 10% interest in Shen to Venari was announced, establishing a basis for fair value.[265] The sales price was $7 MM at closing and $15 MM if Venari proceeds with the final investment decision (FID). Some AFE balances were also included in the transaction but assumed to be small relative to the purchase price. Assuming a 50% chance of proceeding after FID, the risk weighted fair value is estimated at $14.5 MM[266] for the 10% working interest, which would indicate Anadarko's 30% interest might have had a comparable sales value of just $43.5 MM, significantly less than the carried book value. All remaining partners exercised their preferential rights to increase their working interest. In my opinion, Anadarko was probably pursuing a strategic consolidation for resale value.

307. In a presentation[267] titled "Forward Plan Formulation – EC Discussions," one of the items discussed by the Executive Committee on April 26, 2016 was "*Shenandoah development*

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[263] Same.

[264] APC-00686987 dated 2/5/16.

[265] APC-00668987 dated 3/31/16.

[266] $14.5 MM = $7 MM + 0.5 chance of FID*$15 MM upon FID.

[267] APC-01355223 dated 4/26/16, page 5.

case with significantly lower economic performance" (emphasis added). This statement demonstrates that senior management recognized and discussed the negative changes in the economics of developing the Shen field following Shen-4. Shen was disinvested in four out of the six scenarios, shown on page 14 of the presentation.

308. In a strategy development meeting on June 13, 2016, the Executive Committee compared four scenarios,[268] three of which excluded further investment in the Shen project. To exclude Shen investment from three out of four scenarios reflects a low amount of confidence held by senior management in the economic viability of a Shen development.

309. In a June 15, 2016 presentation titled "EC Planning Session – Asset Overviews,"[269] the Shen overview slide listed its top weakness was "*Geologically complex; penetrations not in pressure communication; and* ***resource size shrinking with appraisal***" *(emphasis added).*

310. In a presentation[270] titled "2016 Strategy Development – Executive Committee Update," dated July 5, 2016, the top weakness of the Shenandoah Project was identified as "Current development economics challenged." Exhibit 78 from the same slide shows that the Executive Committee considered the Shen asset as having no value and states so very explicitly. In my experience, senior management would also have been aware of the considerable book value being carried by this valueless asset.

Key Play Statistics	
Net Revenue / Working Interest	28% / 35%
Undeveloped Resource, Net (MMBOE)	113
2016 Capital Allocation ($MM)	108
Base Case NAV @ $60/$2.75 ($B)	0.0

Exhibit 78: Key Play Statistics

311. Further evidence of Anadarko senior management having lost confidence in the commercial viability of proceeding with developing the Shenandoah Field is provided in an email exchange[271] between Executive Committee members. In a summary of key points from a recent portfolio modeling exercise, Hollek states the following with Walker and Gwin copied in the exchange:

> *"**4. Under both scenarios, the model chooses not to invest in Shenandoah and it is deactivated post-2017**." (Emphasis added.)*

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[268] APC-01362172 dated 6/13/16, file "2016 Strategy Development – EC Update June 13 2016 FINAL.pptx," pages 6, 9, 12.

[269] APC-01362258 dated 6/13/16, page 13.

[270] APC-01363508 dated 7/5/16, page 17, table from same page.

[271] APC-00290058 dated 12/14/16.

312. In March 2017, McGrievy[272] informed Abendschein that the EC discussed a substantial write-down of the net book value carried by the Shen asset in December 2016. This write down demonstrated that Anadarko senior management did not view Shen as a going concern and therefore action was required to address the impairment of an uneconomic asset. This December 2017 discussion happened even before Shen-6 was reported to be a dry hole. "*I understand, talking with Luis, that Chris Champion did set the stage with some of the executive team in December, 2016 to let them know that a fairly substantial write-down at Shenandoah would be imminent in 2017" (emphasis added).*

313. In my expert opinion, if economic scenarios included the downside potential that reflected the information available at this time regarding fault compartmentalization and asphaltene deposition in the reservoir, production tubing and flowlines, further appraising the Shen discovery would have been uneconomic after Shen 4. The economic scenarios appear disconnected from the growing reality of fault compartmentalization, minimizing the chances of adequate pressure support from an aquifer. Senior management appeared to be working from a more pessimistic perspective regarding Shen's commercial viability than were represented in Anadarko's economic evaluations.

P. Shen-5

314. Partway through the drilling of Shen-5 and encountering oil in all sands down to the top of LWC sand, the Shen resource evaluation was revised by mapping a Proven, Low, Mid, and High oil in place volumes and applying a range of recovery factors to determine recoverable resource. The Mid oil in place volume and the Moderate Aquifer recovery factor scenario in Exhibit 79[273] below yielded a base case of 422 MMBOE, nearly the same as the Joint Model before Shen-5 was drilled.

[272] APC-00307805 dated 3/31/17

[273] APC-00704026 dated 7/26/16, page 16, in file titled "Shenandoah July 2016 EC Update for presentation.pptx."

Development Scenarios – Low-Mid-High Case

LOW	MID	HIGH
		
	STOOIP	
727 MMBO	1,596 MMBO	2374 MMBO
	Recoverable Resource	
22% Recover Factor	22% Recover Factor	22% Recover Factor
192 MMBOE	422 MMBOE	629 MMBOE
	Phase 1	
First production 7/2021	First production 7/2021	First production 7/2021
5 producers; 1 flow loop	5 producers; 1 flow loop	5 producers; 1 flow loop
	Phase 2	
No Phase 2	4 additional producers	5 additional producers
	Phase II startup 2/2024	Phase II startup 2/2024
	Total Producers	
5 wells	9 wells	10 wells

Exhibit 79: Updated Resource Estimate with Partial Shen-5 Results (7/26/16)

315. The economics summary based on this resource assessment is provided in Exhibit 80[274] below, showing a positive after-tax NPV10 of $175 MM at $50/bbl after a net capital investment of $1,677 MM in the Mid Case. These economics assume no need for injection wells, and pressure support from the aquifer is sufficient to prevent asphaltene deposition. In other words, none of the downside effects of fault compartmentalization and asphaltene deposition were included in the costs, well performance, or recovery, despite the strong evidence to the contrary from Shen-4 and Shen-5. In my expert opinion, these economics represent a best-case scenario, and more representative economics would most likely have been negative if some of the downsides of compartmentalization and asphaltene deposition were included.

[274] Same, page 18.

Economic Summary – Deterministic Cases

Evaluation start date: 7/2016

	Net EUR (MMBOE)	Gross EUR (MMBOE)	Invest $50/BBL				Upside $70/BBL				F&D ($/BOE)	Breakeven Price ($/BBL)	
			NPV10 ($MM)		PIR10		NPV10 ($MM)		PIR10				
			BTAX	ATAX	BTAX	ATAX	BTAX	ATAX	BTAX	ATAX		BTAX	ATAX
Low Case	53	192	-124	-110	-0.14	-0.12	260	132	0.29	0.15	24	56	59
Mid Case	117	422	345	175	0.31	0.16	1047	617	0.94	0.55	15	40	42
High Case	175	629	790	454	0.69	0.40	1704	1031	1.49	0.90	11	32	34

Exhibit 80: July 2016 Economics Update (7/26/16)

316. Even with optimistic assumptions, the after-tax PIR10 of 0.16 for the Mid Case was well below the Anadarko's threshold of 0.3 at $50/bbl. At $70/bbl the PIR10 was 0.55 but based on highly optimistic assumptions discussed above.

Q. Post-Shen-5 Economics

317. With results from Shen-5, every oil-bearing well in the Shen field proved to be in separate pressure compartments and the recoverable resource estimate continued to diminish.

318. On September 14, 2016, a meeting was held to update the Executive Committee on the results of Shen-5. Although the measured pay totaled an encouraging 1,043 ft. TVT of oil-bearing sands, several findings[275] provided more evidence for compartmentalization as follows:

- When adjusted for depth, pressures in the LWA in Shen-5 were substantially lower than in Shen-1, Shen-2, and Shen-4. In other words, the oil zones encountered in all four oil-bearing wells so far are pressure isolated from one another, proving a substantial amount of compartmentalization.

- Pressure trends shifted within the same horizon in the UW2 and UW3, establishing more vertical compartmentalization than observed in previous wells.

- A total of 22 ft. of tar was encountered in the LWC sand, the cause and impact of which is a challenge to explain fully, and oil samples from the Lower Wilcox horizons had heavier oils with API gravities below 30° API. Such variable fluid properties supported a model of a heavily compartmentalized reservoir. The tar and heavier oils were also likely to have an adverse effect on recovery efficiency in the deeper sands.

319. This presentation also updated the estimated recoverable resource volume. Exhibit 81 below shows a revised estimated mean[276] of 353 MMBOE (untruncated), down 17% from 426 MMBOE for the joint model. Structure maps in Exhibit 81 show the basis for the mapped areas assumed in the calculation. The P90 map is significant because it shows the oil accumulation

[275] APC-01228541 dated 9/14/16, pages 10-14.

[276] APC-01228541 dated 9/14/16, page 73.

terminating between Shen-5 and the planned Shen-6 location to the east. The downside area included the risk of faults limiting the eastern extent of the oil accumulation.

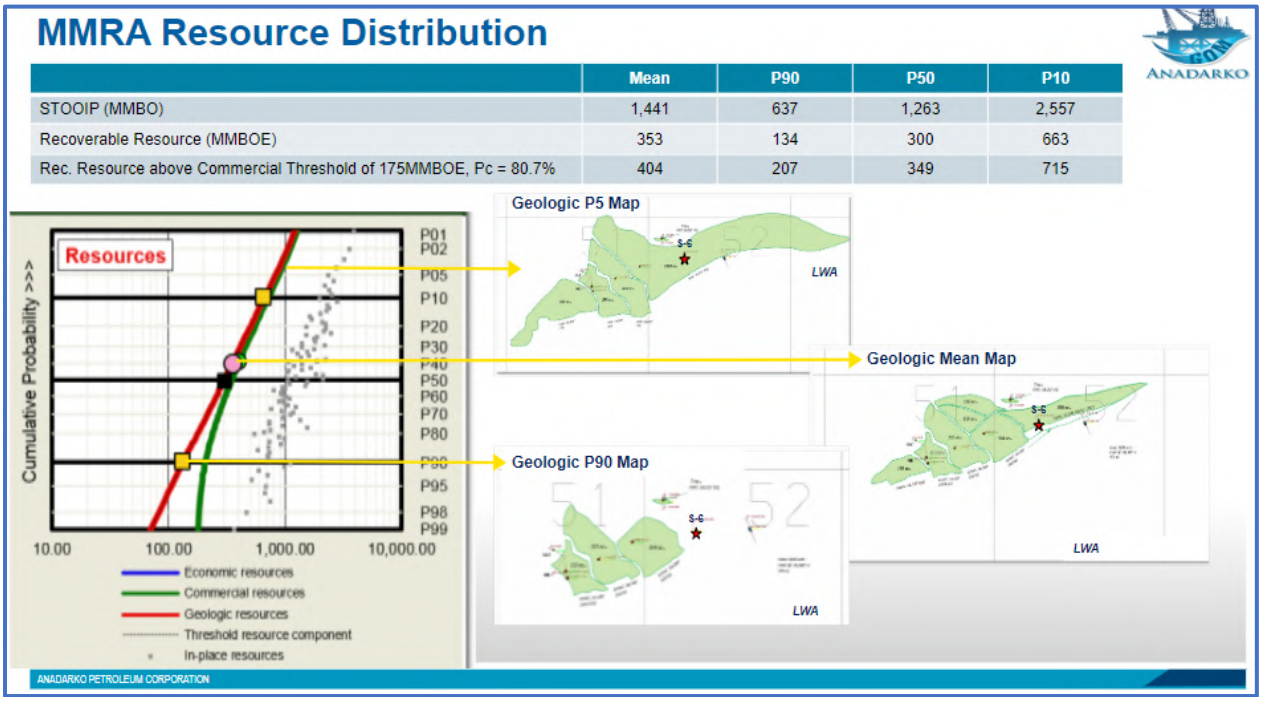

Exhibit 81: Revised MMRA Model with Areas Mapped (9/14/16)

320. Exhibit 82 compares input assumptions[277] in MMRA and Multizone models used to calculate recoverable resource distributions before and after Shen-5. The primary input parameter causing the reduced volume was the lower P90 area of 748 acres in the post-Shen-5 calculation compared to the P90 sum of 1,989 acres for the west and east blocks assumed in the joint model post-Shen-4.

[277] APC-01227989 dated 9/9/16, original MMRA file not identified in document file.

		Post Shen-5	1/11/16 Meeting		Exploration's	
		Development	Joint Model		Model 1/22/16	
Block Areas		1 Zone MMRA	West Block	East Block	West Block	East Block
Risk		100%	100%	75%	100%	85%
Area, Acres	P90	748	1,006	983	1,129	738
	P10	3000	1,521	1628	1,521	1521
Net Pay, ft	P90	890	611	611	790	790
	P10	1020	1,000	1000	1,063	1,063
Recovery Factor	P90	17.8%	13.8%	13.8%	17.7%	17.7%
	P10	22.0%	30.3%	30.3%	32.4%	32.4%
Resource, MMBOE	P90	134	185		312	
	Mean	353	426		548	
	P10	663	694		807	
** average of P90 values and P10 values for area*						
*** sum of all P90 and P10 net pay values*						

Exhibit 82: Post Shen-5 Resource Estimate and Prior Evaluation (9/9/16)

321. The economics by the Development Team for the P90, P50, and P10 scenarios are provided in Exhibit 83.[278] The risked mean case is the probability-weighted result of the three development scenarios and an appraisal failure scenario with a probability of 19.3% of finding a resource volume below the minimum commercial field size (MCFS) of 175 MMBOE. The resulting rate of return for the risked mean is 15.6% and 11.1% for the P90 case, and the PIR10 values were 0.27 and 0.04 for the risked mean and P90 cases, both below the PIR10 threshold.

Economic Summary ($60) and Sensitivities on Investment

$60 Price Deck	Risked Mean	P90	P50	P10
ATAX NPV10 Net ($MM)	223	37	192	650
ATAX PIR10	0.27	0.04	0.19	0.59
ATAX ROR	15.6	11.1	14.4	19.6
F&D	13.77	21.44	16.85	9.18
LOE	7.31	8.24	8.92	5.99
Gross Invest ($MM)	3,899	3,745	4,957	5,536
Gross Resource (MMBOE)	336	207	349	715
Oil Price for PIR=0.3	$61.75	$77.50	$66.50	$48.25
			P_s = 80.7%	*MCFS = 175 MMBOE at $60*

Exhibit 83: Economics Update (9/14/16)

322. However, these economic cases were again based on a very optimistic assumption of pressure support from a robust aquifer three times larger than the oil accumulation.[279] Flowing pressures must be maintained above a minimum flowing bottomhole pressure of 11,000 psig to mitigate asphaltene deposition in the reservoir. Compartmentalization from east-west trending faults would isolate up-dip producers from the aquifer, requiring an injection well be paired with each producer within compartment boundaries that are not resolvable with the seismic data. No costs for injection wells were included in this version of the economics. Shotts' reservoir modeling

[278] APC-01228541 dated 9/14/16, page 76.

[279] Same, page 72.

work[280] dated August 19, 2014 had already demonstrated the tremendous negative impact of mild east-west faulting, potentially reducing the recovery factor from 26% for an unfaulted case down to only 5% for a case with mild north-south and east-west faulting.[281]

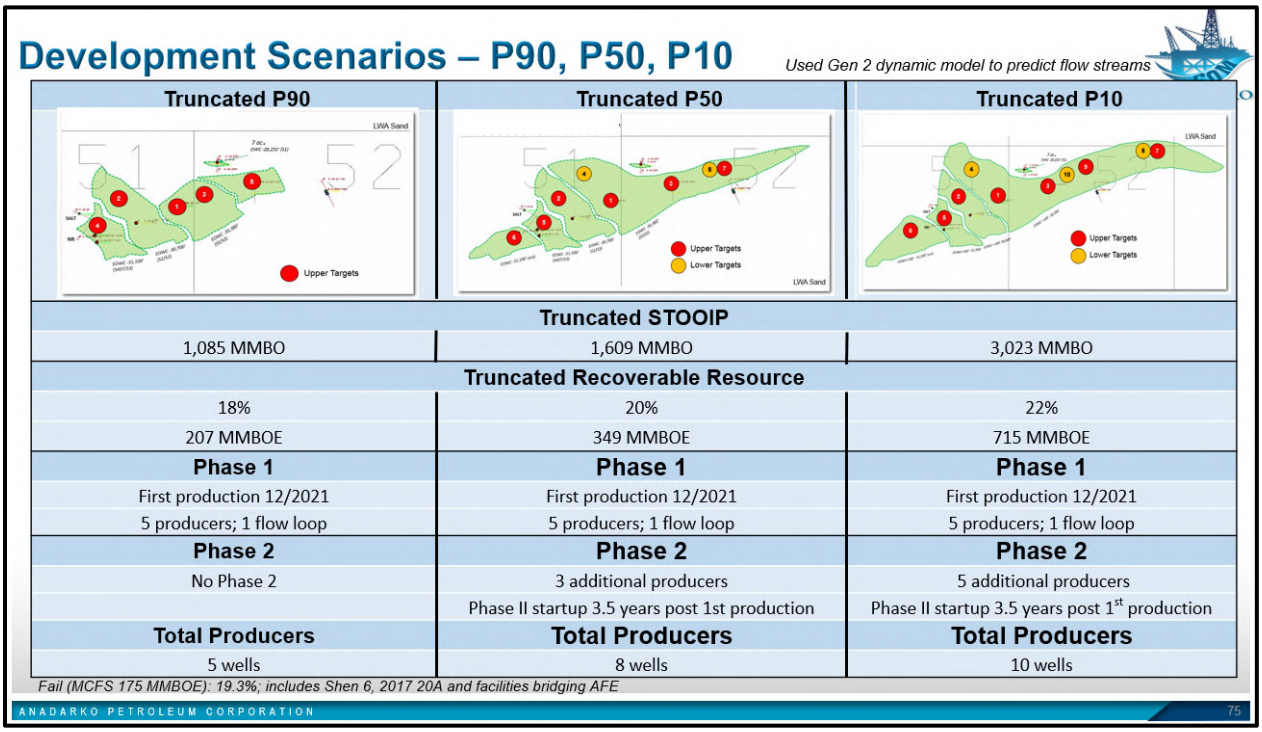

Exhibit 84: Development Scenarios for P90, P50, and P10 Outcomes (9/14/16)

323. At this time, the optimistic assumption of continuity between each producer and the aquifer clashed with key findings from Shen-3, Shen-4, and Shen-5 regarding the prevalence of compartmentalization. An east-west fault through the base of Shen-3 was included in structure maps as early as May 13, 2015.[282] Shen-4BP1 was drilled 300-400 ft. from Shen-4ST1, yet was missing three zones and had 24% (153 ft.) less net oil pay than encountered in the sidetrack. The two wellbores were in separate pressure compartments, demonstrating complex compartmentalization on a very small scale.

324. With results from Shen-5, every oil-bearing well in the Shen field proved to be in separate pressure compartments. Sands within the same zone even showed vertical pressure compartmentalization from each other. The 22 ft. of tar-bearing sands in the Shen-5 LWC zone and lower API oils in the well in the Lower Wilcox sands further demonstrated compartmentalization allowing fluid properties to vary laterally and vertically. Given the strength of this evidence for compartmentalization on an alarmingly small scale, the assumption that aquifer

280 APC-00137267 dated 8/19/14, pages 44-48.

281 APC-01228541 dated 9/14/16, page 75.

282 APC-00001683 dated 5/13/15, page 14.

support would be sufficient in both the P90 and P50 scenarios to avoid asphaltene dropout and provide high recovery factors was inexplicably optimistic, in my expert opinion.

R. Post Shen-6

325. Shen-6 was yet another unsuccessful well. The findings from Shen 6 were a cascade of negative information regarding the small scale of the compartmentalization from faults beyond the seismic data resolution. The original hole was wet and proved pressure isolated with Shen 5. Then, the sidetrack was targeted down-dip of Shen 5 but was wet, proving the Shen 5 block was smaller than anticipated. Next, the bypass core proved wet and fault separated from the nearby sidetrack based on missing sands and encountered tar deposition within the Upper Wilcox sands.

326. On February 5, 2017, Chandler[283] notified the Development team that Shen-6 is wet as follows:

> *"As you can see the UW 2 appears to be wet as does the upper portion of the UW3. This was the one scenario we feared the most. I don't have any good recommendations at this time other than to keep drilling to confirm the deeper sands are indeed all wet. . . . It's a really tough call but there are no good options at this point anyway."(Emphasis added.)*

327. The target of the Shen-6ST1 was the southern part of what was thought to be the Shen-5 oil-bearing block. Instead, the Shen-6ST1 wellbore penetrated wet sands in the UW2 formation before drilling problems,[284] proving the Shen-5 fault block was smaller than mapped. In the bypass core, the UW1 and UW2 were wet. Drilling operations ceased after running into problems with tar and lost circulation in the UW3 formation,[285] proving again that faulting and compartmentalization were much more complex than mapped. The presence of tar also proved that asphaltene deposition had already occurred historically within the reservoir.

328. On May 2, 2017, defendants filed the 1Q2017 10-Q, disclosing that Anadarko had "*suspended further appraisal activities" (emphasis added)* on the Shen project and had taken a $467 MM impairment for the purchase price of the leases and a $435 MM charge for previously capitalized expenses**.**

VII. CONCLUSION

329. Based on my review of the technical work and the evidence as detailed above, I conclude that Anadarko personnel and management knew that Shen was probably commercially unviable following Shen-3 and unviable with reasonable certainty after Shen-4 due to extensive fault compartmentalization and asphaltene deposition. I submit on my summary of opinions as

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283 APC-00361054 dated 2/5/17.

284 APC-00309656 dated 4/10/17.

285 APC-00306002 dated 3/21/17, page 2.

stated above. As previously stated, I reserve my rights to add to this report as new information becomes available, and am willing to testify before the Court.

Lyndon Pittinger
Consulting Petroleum Engineer

APPENDIX A: Pittinger Résumé and Work History

Lyndon Pittinger, Consultant

27 Jumping Jacks Lane
Amissville, VA 20106

540-937-1778 lynnpittinger@gmail.com

SUMMARY

Experienced consultant in petroleum engineering, economic evaluation, and decision analysis, with current focus on analyzing the performance of unconventional plays. Evaluated several hundred exploration, development and acquisition projects worldwide, with several resulting in significant company impact. Contributed to company-wide initiatives to improve risk and resource assessment best practices. Worked overseas for 10 years in Southeast Asia and the North Sea, with extensive travel in the former Soviet Union and Latin America. Balance of experience in operations, new ventures and deepwater. Team-oriented worker successful in facilitating cross-functional teams.

EXPERIENCE

CONSULTANT **2008-Present**

Consulting projects include mostly onshore US reserve and prospect evaluation working with Labyrinth, Ammonite Resources, Rose and Associates, GaffneyCline, private equity firms, hedge funds and law firms in economic evaluation, decision analysis and reservoir engineering. Completed several dozen evaluations of well performance and economics in the Eagle Ford, Bakken, Marcellus, Haynesville, Barnett, Mississippi Lime, Utica, Niobrara, Woodford and Fayetteville shale plays. Also completed due diligence for over 50 conventional plays and prospects. Co-authored articles in World Oil on unconventional plays. Testified to U.S. congressional hearing on shale gas supply. Awarded Outstanding Technical Editor for SPE Economics and Management series for three years.

EXPERT WITNESS

- Consultant on class action lawsuit, providing extensive analysis of discovery documents.
- Wrote expert witness report for an UNCITRAL international arbitration case in 2015-2016 for Steve Harris, partner at Squire Patton Boggs. Testified at the Court of Arbitration for 3.5 hours, questioned mostly by opposing lawyer, a partner at Skadden.
- Wrote expert report and was deposed on 8/19/16 in case KB Resources, LLC, et al. vs. Patriot Energy Partners working with John Hill, attorney.
- Prepared expert witness report in 2014 for the Department of Justice, after which case was settled, involving no testimony or deposition. - Petro---Hunt, LLC v. United States, Case No. 00---512L (Fed. Cl.); DJ No. 90---1---23---10071, Bill Shapiro, Attorney.
- Deposed for two full days in 1988 in litigation between PG&E and Unocal.

OCCIDENTAL OIL & GAS CORP., Houston, Texas ***.....2001-2007***
Sr. Economics and Planning Consultant *.....2003-2007*
Provided commercial assessments of exploration prospects and plays in Latin America and deepwater, and consulted on country level strategy. (Part-time work 50%-75%)

Chief of Exploration Economics ***.....*** *2001-2003*
Managed economic evaluations for Exploration Division ($150 MM/year capital budget)

- Reviewed all capital requests pushing for consistency across portfolio.

- Developed play analysis guidelines and tools for resource assessment and risk analysis.
- Promoted from Manager to Chief in first year.

UNOCAL, Sugar Land, Texas ***1981-2000***
Manager of Evaluations, Spirit Energy *2000*
Led economic evaluation team supporting major projects over $5 million in shelf and deepwater Gulf of Mexico, both exploration and operations ($600 million/year capital program).
- Changed evaluation guidelines to ensure economics better reflect overall profitability of mature Gulf of Mexico shelf business.

Manager of International Evaluations, Sugar Land, Texas *1998-2000*
Managed evaluation professionals supporting teams working in Asia, Latin America and West Africa ($5 million projects to >$100 million acquisitions). Worked toward changing role of evaluations from running numbers to developing comprehensive business cases to support management decision making.
- Pushed teams for more realistic assumptions in project evaluations, providing a more pragmatic assessment of the company's growth opportunities.
- Developed risk analysis process to include commercial, political and competitive issues in assessing project viability, resulting in better consistency between regions.
- Technical Integration Leader for deepwater evaluations across the company.

Director Petroleum Engineering, Bangkok, Thailand *1995-1998*
Managed Petroleum Engineering Department and functional leader for petroleum engineers in asset teams producing 1 billion cubic feet per day.
- Led improved recovery initiatives in well completion, stimulation, and water shut-off to improve recovery efficiency of 500 development wells.
- Improved reserve assessment process for 7 Tcf development inventory, reducing revisions.
- Coordinated engineering and economic evaluations of over 30 farm-in and lease opportunities and five major acquisition bids of $50-300 million.
- Technology Integration Leader of reservoir engineering and economics for company-wide Deep Water Team.

Sr. Advising Petroleum Engineer, Sugar Land, Texas *1994-1995*
Operation Process Team member reporting directly to the Vice President of Worldwide Operations, implemented changes to improve reservoir engineering processes company-wide.
- Organized peer reviews of major projects, led workshops on sharing of best practices and contributed to company guidelines for risk and reserves assessment.

Advising Petroleum Engineer, Sugar Land, Texas *1991-1994*
Evaluated reservoir engineering and economics for international new ventures and supported PSC negotiations, with focus on Southeast Asia and Former Soviet Union Republics.
- Received awards for contributions leading to capture of projects in Azerbaijan and Vietnam.
- Seconded to Amoco for Azeri Field Feasibility Study from 12/91 to 6/92.
- Mentored engineers and worked on team to develop risk and reserve assessment guidelines .

Senior Petroleum Engineer, Aberdeen, Scotland *1988-1991*
Reservoir engineer supporting operations and exploration in the North Sea and new ventures in the former Soviet Union. (Promoted to Senior level 4/91)

- Significant contributor to Unocal's entry into the Azeri Field, which later became a 10% interest in the Azerbaijan International Oil Consortium, a 4.5 billion barrel development.
- Completed reservoir simulation, development, well test and unitization studies for the Nevis Field and assessed risked economics for North Sea exploration portfolio.

Geothermal Reservoir Engineer, Manila, Philippines, Jakarta Indonesia, California.....*1981-1988*

Managed reservoir engineering for the Tiwi Field generating 300 MW, monitored performance, recommended drilling programs and changed reinjection strategy to reduce thermal breakthrough. Trained staff of reservoir engineers. Lead reservoir engineer for the Gunung Salak Field responsible for reservoir field studies, reserve assessments, field testing programs and appraisal strategy. Responsible for monitoring well performance and development well scheduling at the Geysers Field. Improved reserve assessment methods impacting field expansion strategy. Extensive testing of reservoir simulation models.

EDUCATION

Degree of Engineer (Management Option), Petroleum Engineering, Stanford University
Degree included one year of graduate study in economics, finance and decision analysis

B.S., Mechanical Engineering, Stanford University
Elected to Tau Beta Pi and received athletic scholarship in golf

APPENDIX B: Documents and Information Considered in My Report

I have relied on all of the documents and testimony cited in my report, including the text and footnotes therein. I have listed below other documents that I considered in preparing my report.

Document Database
As part of my engagement, I was provided access to the extensive database (*i.e.*, online Relativity software accessed database) containing relevant information, including documents produced by defendants in this case and certain third-parties. I reviewed a significant volume of documents in the database.

SEC Filings
Anadarko 2014 SEC Form 10-K for the fiscal year ended December 31, 2014
Anadarko 2015 SEC Form 10-K for the fiscal year ended December 31, 2015
Anadarko 2016 SEC Form 10-K for the fiscal year ended December 31, 2016
Anadarko 2016 2Q 2016 SEC Form 10-Q
Anadarko 2016 3Q 2016 SEC Form10-Q
Anadarko 2016 1Q 2016 SEC Form 10-Q
Anadarko 2017 1Q 2017 SEC Form 10-Q

Anadarko Case Depositions and Exhibits
Deposition of Lea Frye and Exhibits
Deposition of Darrell Hollek and Exhibits
Deposition of Ernest Leyendecker and Exhibits
Deposition of Patrick McGrievy and Exhibits
Deposition of Charles Oudin and Exhibits
Deposition of Chris Camden and Exhibits
Deposition of Doug Shotts and Exhibits
Deposition of David Blakeley and Exhibits
Deposition of James J. Kleckner and Exhibits
Deposition of Paul Chandler and Exhibits
Deposition of Patrick McGrievy and Exhibits
Deposition of Robert Strickling and Exhibits
Deposition of Jonathan Ramsey and Exhibits
Deposition of Robert Walker and Exhibits
Deposition of Robert Gwin and Exhibits

Anadarko Press Releases, Transcripts, Presentations and Media
2013.03.19 Press Release re: Shenandoah Appraisal well
2014.03.04 Presentation 2014 Investor Conference
2014.03.04 Transcript 2014 Investor Conference
2014.10.31 "Conoco Phillips throws in the towel on Coronado," https://www.oedigital.com/news/454266-conocophillips-throws-in-towel-on-coronado
2015.02.03 Transcript Q4 2014 Anadarko Petroleum Corp Earnings Call
2015.03.03 Presentation 2015 Anadarko Investor Conference Call
2015.03.03 Transcript Anadarko Petroleum Corp 2015 Capital Program and Guidance Call
2015.05.05 Transcript Q1 2015 Anadarko Petroleum Corp Earnings Call

2015.05.20 Transcript Anadarko Petroleum Corp at UBS Global Oil and Gas Conference
2015.07.28 Press Release re: Q2 2015 financial results
2015.07.29 Transcript Q2 2015 Anadarko Petroleum Corp Earnings Call
2015.10.27 Press Release re: 3Q 2015 financial results
2016.05.24 A39:A52Transcript Anadarko Petroleum Corp at UBS Global Oil and Gas Conference
2016.02.24 Transcript Anadarko Petroleum Corp at Credit Suisse Energy Summit
2016.05.24 Transcript Anadarko Petroleum Corp at UBS Global Oil and Gas Conference
2016.07.27_Transcript Q2 2016 Anadarko Petroleum Corp Earnings Call
2016.08.16_Transcript Anadarko Petroleum Corp at EnerCom Oil & Gas Conference
2016.09.14_Transcript Anadarko Petroleum Corp at UBS Houston Energy Bus-less Tour
2016.11.01_Transcript Q3 2016 Anadarko Petroleum Corp Earnings Call
2017.02.01_Transcript Q4 2016 Anadarko Petroleum Corp Earnings Call

Court Filings

Amended Complaint for Violations of the Federal Securities Laws, *Georgia Firefighters v. Anadarko Petroleum Corp*, Case No. 4:20-cv-000576 [Doc. 55]

Other

Guidelines for Application of the Petroleum Resources Management System, November, 2011, Society of Petroleum Engineers, *et. al*.

APPENDIX C: MMRA and Multizone Combination Process and Files Used

Appendix B:

MMRA and Multizone Combination Process and Files Used in 6/13 Resource Estimate with Mean of 1,197 MMBOE

Zones	MMRA Files	MultiZone files	MultiZone file	MultiZone file
UW1&2	APC-01671275	Combined in		
UW3	APC-01671277	APC-01671281		
			Combined in	Combined in
LWA	APC-01671262		APC-01671284	APC-01671288
LWB	APC-01671263	Combined in		
LWC	APC-01671264	APC-01671278		
LWD	APC-01671265		North of Fault	
LWE	APC-01671266		*file not found*	

MMRA and Multizone Combination Process and Files Used in 11/14 Resource Estimate with Mean of 917 MMBOE

Zones	MMRA Files	MultiZone files	MultiZone file	MultiZone file
UW1&2	APC-00852359	Combined in		
UW3	APC-00852358	APC-01678354		
			Combined in	Combined in
LWA	APC-00852357		APC-01678355	APC-01678786
LWB	APC-00852356	Combined in		
LWC	APC-00852355	APC-01678785		
LWD	APC-00852354		North of Fault	
LWE	APC-00852353		*file not found*	

MMRA and Multizone Combination Process and Files Used in 11/15 Resource Estimate with Mean of 754 MMBOE

Zones	MMRA Files	MultiZone files	MultiZone file
UW1&2	APC-01699930	Combined in	
UW3	APC-01699931	APC-01699937	
LWA	APC-01699933		Combined in
LWB	APC-01699932		APC-01699939
		Combined in	
LWC	APC-01699934	APC-01699940	
LWD	APC-01699935		North of Fault
LWE	APC-01004124		*file not found*

APPENDIX D: Glossary of Oilfield Terms

Authority for Expenditure (AFE)
: Document of an investment proposal containing a description of the investment, cost breakdown, benefits, timing, key milestones and economics submitted for management approval

Appraisal Well
: A well drilled as part of an appraisal drilling program to determine the field's physical extent, reserves, and likely production rate of a field.

Asphaltene
: Asphaltenes are the dissolved solids components of crude oils. Asphaltenes negatively impact the economic value of crude oil and may precipitate out in the reservoir, seriously decreasing the production rate.

Asphaltene Onset Pressure (AOP)
: the pressure at which asphaltenes begin to precipitate from reservoir fluid as pressure decreases at a given test temperature.

Barrel of Oil Equivalent (BOE)
: A measure used to aggregate oil and gas resources or production, with one BOE being approximately equal to 6,000 cubic feet of natural gas.

Biodegradation
: Bacterial action impacting oil properties in the reservoir, leading to a systematic decrease in paraffin and an increase in oil density, sulfur content, acidity, and viscosity. Biodegradation is often accompanied by water-washing.

BCF
: One billion cubic feet of natural gas at standard conditions.

BOPD
: Measure of production rate, barrels oil per day (BOPD)

Bypass Well
: It is typically drilled to acquire a core near an existing borehole along a wellbore path adjacent to a previously existing wellbore's bottomhole.

Coil Seismic
: "Coil shooting" is a single-vessel method developed by WesternGeco for acquiring seismic data over a wide range of azimuths to improve imaging of complex geology.

Commercial Field
: An oil and/or gas field judged to be capable of producing enough net income to make it worth developing.

Depth Migration

A step in seismic processing in which reflections in seismic data are moved to their correct locations in space, including position relative to shot points, in areas where there are significant and rapid lateral or vertical changes in velocity that distort the time-image. Seismic data are acquired in time for a reflection to travel to a reflecting interface and back to the surface. The travel time is multiplied by the seismic velocity of the rock through which the signal travels to convert travel time to depth. This conversion requires accurate knowledge of vertical and horizontal seismic velocity variations.

Dry Hole

A well incapable of economically producing saleable hydrocarbons in sufficient quantities to justify commercial exploitation. Often referred to as “wet” if only water is encountered.

Estimated Ultimate Recovery (EUR)

The sum of reserves remaining as of a given date and cumulative production as of that date.

Exploratory Well

A well drilled to find a new field or a new reservoir in a field previously found to be productive of oil or gas in another reservoir.

FID

Final Investment Decision.

Field

An area consisting of a single hydrocarbon reservoir or multiple geologically related reservoirs all grouped on or related to the same individual geological structure or stratigraphic condition.

GOR

Gas Oil Ratio measured in standard cubic feet per barrel (scf/bbl).

HC’s

Hydrocarbons (oil and natural gas).

HKW

Highest Known Water – highest elevation of water encountered by a wellbore in a given horizon of interest.

Homocline

A geological structure in which the layers of a sequence of rock strata dip uniformly in a single direction having the same general inclination in terms of direction and angle.

Lead

An area where the major components of the hydrocarbon system have sufficient probabilities of success in contributing to an economic accumulation of hydrocarbons.

LKO

Lowest Known Oil – the deepest occurrence of[[[of???]]] oil encountered by a wellbore.

LOE

Lease Operating Expense

MCF

"One thousand standard cubic feet of natural gas. In the United States, standard conditions are defined as gas at 14.7 psia and 60°F."

MCFS

Minimum commercial field size. The field size at which development becomes economic. The use of "commercial" has been used to signify economic on a point-forward basis.

MEFS

Minimum economic field size. The field size at which development becomes economic. The use of "economic" has been used to signify economic on a full cycle basis.

MDT

Modular Formation Dynamics Tester – Schlumberger logging tool to collect pressure and fluid data at various depths in a wellbore.

MMBOE

Million Barrels of Oil Equivalent is a measure of both gas and oil. Gas is typically converted based on 6000 standard cubic feet of gas (SCFG) to 1 barrel of oil.

MMRA

Multi-Mode Resource Assessment Tool. A probabilistic resource assessment software developed by Rose & Associates in common industry use for over 30 years.

NAV

Net Asset Value (NAV) is the value of an entity's assets minus the value of its liabilities

NPV

Net Present Value – the difference between the present value of cash inflows minus the present value of cash outflows over life of the investment. NPV10 means cash inflows and outflows are discounted at 10%/year. Also AT NPV10 is After-Tax Net Present Value

NRI

Net Revenue Interest – share of revenue accounting for working interest and royalty payments.

NRR

Net Risked Resource – the net share based on net revenue interest of the probability weighted resource volume.

Operator
: The entity responsible for managing operations in a field or undeveloped acreage position.

OWC
: Oil-Water Contact.

Permeability
: The permeability of a rock is the measure of the resistance to fluid flow through the rock. High permeability means fluid passes through the rock easily.

Fractiles (P1, P10, P90 and P99)
: The value of a distribution in which that percentage is greater than. For example, 1% of the outcomes exceed the P1, 10% of the outcomes exceed the P10, 90% exceed the P90, and 99% exceed the P99. The P1 value can be thought of as representing the absolute maximum outcome, the P10 as the upside outcome, the P90 as the downside case, and the P99 as the absolute minimum.

PIR
: Profit to Investment Ratio – NPV/capital investment typically discounted. PIR10 means numerator and denominator are discounted at 10%/year.

Play
: An area in which hydrocarbon accumulations or prospects with similar characteristics occur, such as the Lower Tertiary play in the deepwater Gulf of Mexico or the Marcellus play in the eastern United States. A group of prospects of a similar nature constitutes a play.

Porosity
: The measure of a rock's ability to hold a fluid. Porosity is typically expressed as a percentage of the total rock volume or area is taken up by pore space.

Prospect
: An area of exploration in which hydrocarbons have been predicted to exist in economic quantity. A prospect is commonly an anomaly, such as a geologic structure or a seismic amplitude anomaly that is recommended by explorationists for drilling a well. Justification for drilling a prospect is made by assembling evidence for an active petroleum system or reasonable probability of encountering reservoir-quality rock, a trap of sufficient size, adequate sealing rock, and appropriate conditions for the generation and migration of hydrocarbons to fill the trap. A single drilling location is also called a prospect, but the term is more properly used in the context of exploration.

psig
: Measure of pressure in pounds per square inch. Gage pressure = 0 psig at atmospheric conditions

RCT
: Risk Consistency Team, an Anadarko name for the "Peer Review Team."

Reserves

Estimated remaining quantities of oil and gas and related substances anticipated to be economically producible, as of a given date, by application of development projects to known accumulations. In addition, there must exist, or there must be a reasonable expectation that there will exist, the legal right to produce or a revenue interest in production, installed means of delivering oil and gas or related substances to market, and all permits and financing required to implement the project. Generally classified as Proved (1P), probable (P2), and possible (P3). Proved Reserves are also classified as Developed Producing, Developed Behind Pipe, and Undeveloped.

Reservoir

A porous and permeable underground formation containing a natural accumulation of producible oil and/or gas that is confined by impermeable rock or water barriers and is individual and separate from other reservoirs.

Resources

Quantities of oil and gas estimated to exist in naturally occurring accumulations. A portion of the resources may be estimated to be recoverable, and another portion may be considered unrecoverable. Resources include both discovered and undiscovered accumulations. Resources are classified as Contingent Resources, development-pending, development on hold, or development not presently viable, or Prospective Resources of a Prospect, Lead, or Play.

ROR

Rate of Return – In the oil and gas industry, ROR is typically defined as the discount rate that yields a zero net present value for cash flows from an investment of capital.

Sidetrack Well

A wellbore segment extending from a wellbore intersection along a wellbore path to a different wellbore bottomhole from any previously existing wellbore bottomholes.

SPAR

A marine floating oil and gas platform consisting of a large-diameter, vertical buoyant cylinder supporting a deck. The development program proposed by Anadarko uses two spars; thus, it is referred to as a two-spar development.

Stratigraphic Variability

Variation in rock units displayed as visible layering caused by physical contrasts in rock type (lithology), e.g., sand and shale. This variation can occur vertically as layering (bedding) or laterally, reflected by lateral thinning or changes in the depositional environment.

STOIIP

Stock Tank Oil Initially In Place before a recovery factor is applied.

Truncated Resources vs. Untruncated Resources

An untruncated distribution, typically from a Monte Carlo simulation, has not been subject to a threshold cutoff and is commonly referred to as the geologic distribution. A

truncated distribution excludes outcomes that fall below an economic or commercial cutoff, similar to appraisal failure outcomes. Decision tree economics can be more representative by quantifying the probability of appraisal failure, and the resulting post-truncation P90, P50, Pmean, and P90 values are larger than the untruncated values depending on how much of the original distribution fell below the cutoff. A commercial threshold is the minimum value to achieve the required economic return based on point-forward cash flows (sunk costs are ignored). An economic threshold is the minimum value to achieve the required economic return on a full-cycle basis (sunk costs are included).

TST

True Stratigraphic Thickness – Thickness of a formation perpendicular to the dip of the formation.

TVT

True Vertical Thickness – Thickness of a formation in the vertical direction.

Water-washing

The in-situ process of stripping the more soluble hydrocarbons from a gas or oil accumulation via dissolution in the associated aquifer, often accompanies biodegradation.

WAZ Seismic

Wide azimuth (WAZ) describes a seismic data acquisition technique with a wide distribution of source-receiver azimuths.

Weld

A salt weld is a surface or thin zone marking a zone from which all salt has been removed – the weld results from complete or nearly complete salt removal by creep or dissolution.

Well Log

A geophysical tool recording the technical details of the geological strata penetrated (e.g., resistivity, sonic, gamma-ray, density, and neutron).

Wellbore

The hole drilled by a drilling rig to explore for or develop oil and/or natural gas, also referred to as a well or borehole.

Exhibit 23

CONFIDENTIAL

UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF TEXAS

HOUSTON DIVISION

In re ANADARKO PETROLEUM CORPORATION SECURITIES LITIGATION	§	Civil Action No. 4:20-cv-00576
	§	
	§	CLASS ACTION
	§	The Honorable Charles R. Eskridge III

EXPERT REBUTTAL REPORT OF BJORN I. STEINHOLT, CFA
JANUARY 25, 2023

CONFIDENTIAL

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I. BACKGROUND

1. On October 1, 2021, I submitted an expert report in this case that included various analyses demonstrating that new and material information about Anadarko Petroleum Corporation ("Anadarko," "APC," or the "Company") was widely disseminated to the market, analyzed by market participants, and traded on, causing the information to quickly become reflected in the Company's stock price.[1] Specifically, I concluded that (a) the market in which Anadarko common stock traded during the period from February 20, 2015 through May 2, 2017, inclusive (the "Class Period"), was impersonal, open, well-developed, and efficient in that the prices quickly responded to incorporate and reflect new, material information as it became available, and that, therefore, (b) it was reasonable for investors to rely on the integrity of the market price of Anadarko during the Class Period as reflecting all publicly available information.[2] Furthermore, I also concluded that class-wide damages can be calculated in this case using an event study

[1] Expert Report of Bjorn I. Steinholt, CFA, dated October 1, 2021 ("Steinholt Class Cert. Report"), ¶¶19-52. Throughout this report, I use the term "material information" in the manner investors and securities analysts generally use the term, as opposed to a legal conclusion. From an economic point of view, the value of an investment is based on the expected future cash flows of that investment, including the timing and associated risk of those cash flows. Material information, sometimes also referred to as value-relevant information, therefore, is information that impacts the future cash flows or the timing or riskiness of the future cash flows. *See* Jerald E. Pinto, *et al.*, *Equity Asset Valuation*, John Wiley & Sons Inc., at 18-19 (2d ed. 2010) ("The most important type of equity valuation models are present value models. In finance theory, present value models are considered the fundamental approach to equity valuation. . . . A present value model or discounted cash flow model applied to equity valuation derives the value of the common stock as the present or discounted value of its expected future cash flows.").

[2] Steinholt Class Cert. Report, ¶¶7, 60.

damages framework based on the event study methodology, and, if necessary, fundamental valuation principles.[3]

2. On November 17, 2021, I was deposed by Defendants' counsel in this matter.

3. On February 2, 2022, I submitted a rebuttal report in this case (the "Steinholt Class Cert. Rebuttal") responding to various assertions made by Defendants' expert Dr. Allen Ferrell in his report, dated December 10, 2021 (the "Ferrell Class Cert. Report").

4. On November 9, 2022, I submitted another expert report in this case: (a) focusing on whether Defendants' scheme, misleading statements, and deceptive business practices alleged in the Amended Complaint for Violations of the Federal Securities Laws, dated August 17, 2020 (the "Complaint") contained, or omitted, important information that a reasonable investor would have wanted to consider prior to making an investment decision; (b) focusing on whether Defendants' alleged misconduct caused economic losses to investors who purchased Anadarko's common stock during the Class Period; and (c) providing an economic framework to quantify the potential Section 10(b) damages suffered by purchasers of Anadarko's common stock during the Class Period.[4] More specifically, I opined that:

(a) The market in which Anadarko's common stock traded during the Class Period was open, developed, and efficient, in that the market prices during this time period quickly changed to reflect new and material information concerning the Company as such information became available. Specifically, new and material information about

[3] *Id.*, ¶¶53-59, 61.

[4] Expert Report of Bjorn I. Steinholt, CFA, dated November 9, 2022 ("Steinholt Report").

Anadarko was widely disseminated to the market, analyzed by market participants, and traded on, causing the information to quickly become reflected in the Company's stock price.

(b) Defendants' alleged scheme and misleading statements contained, or omitted, information that a reasonable investor would have wanted to consider prior to making an investment decision, causing Anadarko's common stock to trade at artificially inflated prices during the Class Period.

(c) When the alleged truth was publicly disclosed, Anadarko's stock price declined, causing Class members to suffer economic damages as a result of the alleged fraud (*i.e.*, the disclosure of the alleged truth).

(d) The event study framework, as explained in greater detail below, can be used to quantify damages in this case. While this framework is flexible, if Plaintiffs prove all of the allegations, the estimated dollar inflation per share is:

- From February 21, 2015 through July 26, 2016: $1.75 per share[5]
- From July 27, 2016 through May 2, 2017: $1.92 per share.

5. On November 9, 2022, Defendants' expert Mr. Peter Keller submitted an expert report (the "Keller Report").

6. On December 21, 2022, I was deposed for the second time by Defendants' counsel in this matter.

7. On January 17, 2023, Defendants' expert Mr. Keller was deposed (the "Keller Deposition").

8. I have now been asked to review and discuss the Keller Report.

[5] Because the Class Period began with an alleged misleading statement made after the market closed on February 20, 2015, the first day with inflation as a result of that misleading statement would be the next day, February 21, 2015.

II. SUMMARY OF THE KELLER REPORT

9. According to Mr. Keller, he was engaged to "analyze, based on [his] experience, what information concerning Shenandoah was in the market both before and during the Class Period," and to "examine how sophisticated and professional investors in the oil and gas industry [referred to in the Keller Report simply as 'investors'] understood the statements Plaintiffs allege are misleading."[6] Furthermore, according to him, the Keller Report "will be used, among other ways, in support of Defendants' truth-on-the-market defense."[7]

A. Mr. Keller's Attempt to Assess How Investors "Understood" the Publicly Available Information

10. According to Mr. Keller, he was asked to "examine how sophisticated and professional investors in the oil and gas industry [subsequently referred to in the Keller Report simply as 'investors'] understood the statements Plaintiffs allege are misleading."[8]

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[6] Keller Report, ¶15. With respect to the information "concerning Shenandoah [that] was in the market," Mr. Keller references SEC filings, earnings calls, presentations at industry conferences, publicly available analyst reports, and media reports. *Id.*, ¶¶22-27. These are the same types of sources I reviewed prior to forming my opinions in this case. Steinholt Report, ¶12.

[7] Keller Report, ¶15.

[8] *Id.* At his deposition, Mr. Keller defined a sophisticated investor as "an investor who is generally knowledgeable about the way markets works and does a certain level of due diligence," but did not recall also using the term professional investor. Keller Deposition at 57:17-19. Asked whether his "opinions [were] limited to sophisticated investors," Mr. Keller answered: "Not exclusively, no." *Id.* at 58:22-24. He was then asked if he was "including all class members when you say what investors understood," to which he answered: "Yes." *Id.* at 64:7-9. I cannot reconcile Mr. Keller's use of the term "investor" in the Keller Report with his deposition testimony but will attempt to explain the relevant issues as best as I can below without such a full understanding.

However, determining how investors interpreted or understood certain publicly available information is very different than simply stating that the information was part of the public mix of information and, thereby, was reflected in the stock price. Often there are multiple pieces of conflicting information, and other times there is information that can reasonably be interpreted or understood differently by different investors. Consequently, it can be overly speculative to say how specific information (beyond the text itself) was interpreted or understood by individual investors (in the case of Mr. Keller's analysis, sophisticated and professional investors) without any inputs from the investors themselves.[9] A more reliable approach is to analyze how investors collectively reacted to the information when it was disclosed (*i.e.*, how did the disclosure of the information (for example the alleged truth) impact the stock price). Ultimately, the relevant issue in securities fraud cases such as this one is whether the alleged fraud impacted the stock price, and, if so, by how much.

11. The most generally accepted methodology to analyze how an event (or a disclosure of new information) impacted a stock price, both in academia and securities litigation, is the event study.[10] In fact, this is the methodology I used in this case to analyze

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[9] Mr. Keller's focus on how (sophisticated) investors "understood" certain information is very different than opining on what is important information to a reasonable investor. The latter simply involves analyzing whether the information itself was value relevant (*i.e.*, whether the information impacted the future cash flows of the investment).

[10] For a discussion on the event study, *see* the Steinholt Report, ¶¶34-45. *See also* Marge S. Thorsen, *et al.*, *Rediscovering the Economics of Loss Causation*, 6 J. Bus. & Sec. L. 93, 109 (2005) ("Forensic experts agree generally on the techniques to be used to show inflation and dissipation in stock prices. The gold standard, which is accepted by both courts and economists, is the event study. Other tools such as valuation analyses often aid the event study.").

the impact of the corrective disclosure at the end of the Class Period, as well as my quantification of the inflation.[11] Again, the key benefit of the event study is that it provides an objective measure of how investors actually reacted to the information disclosed, collectively, as opposed to opining on the state of mind of specific investors (in the case of Mr. Keller's analysis, the vaguely defined "sophisticated" and "professional" investors) as to how they interpreted or understood the information.

12. Mr. Keller provides his opinions with respect to how investors interpreted or understood the publicly available information without the benefit of any supporting event studies.[12] Nor did he survey any investors or provide any other sound methodology for determining how certain information would have been interpreted or understood by investors.[13] Instead, he (a) cites various publicly available information, generally from the Company or selected securities analysts covering the Company, then (b) summarizes his interpretation or understanding of that information into one sentence, and then (c) claims that this is also how investors understood the information. The one sentence summary of his understanding may very well be how Mr. Keller interpreted or understood the publicly available information. However, absent a sound methodology, there is no basis to claim that Mr. Keller's view is also how other investors understood the information.

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[11] Steinholt Report, ¶¶34-45.

[12] Keller Deposition at 48:2-7 ("Q. You didn't perform an – an event study; correct? A. I did not, no. Q. You didn't perform any other economic analysis? A. I did not.").

[13] *Id.*

13. The notion that every investor would have interpreted or understood the information cited by Mr. Keller in the same exact way is highly unlikely. For example, throughout the Class Period, different market participants had different opinions about the "valuation attributed to Shenandoah," as evidenced in Figure 8 of Mr. Keller's own report, also discussed below.[14] These differences of opinion would necessarily reflect different interpretations or understandings of the publicly available information. Indeed, as I pointed out in the Steinholt Class Cert. Report, an efficient market does not mean that "all market participants agree on what the true value of the common stock is, as evidenced by the fact that some investors sell as others buy," rather, "it means that the respective investors' views of the stock's true value drives their purchases and sales (*i.e.*, the demand and supply for the stock), which, in turn, becomes the basis for the consensus price set by the overall market."[15]

B. Mr. Keller's Incomplete Truth-on-the-Market Defense

14. The Keller Report states that it "will be used, among other ways, in support of Defendants' truth-on-the-market defense."[16] However, Mr. Keller does not provide any evidence in this case that the alleged truth (*i.e.*, Anadarko's suspension of appraisal

[14] Keller Report, Figure 8.

[15] Steinholt Class Cert. Report at fn 9. At his deposition, Mr. Keller appears to concede this fact, stating: "How do I choose between conflicting opinions? I think you – you come to some sort of a consensus, if you will." Keller Deposition at 30:2-4. However, nowhere in the Keller Report does he discuss the conflicting opinions, or how he determined what the consensus was.

[16] Keller Report, ¶15.

activities at the Shenandoah, was disclosed prior to May 2, 2017 (after the market closed)).[17] Nor does he perform an event study (as I did) to analyze whether the disclosure of the alleged truth, in fact, impacted Anadarko's stock price (it did).

15. Instead, Mr. Keller appears to lay the groundwork for a different argument, that investors, having access to "'all the information [about Shenandoah] that can be acquired by painstaking analysis of the company and the economy,'" would have uncovered the alleged truth (if true), and that this truth would therefore already be reflected in the stock price prior to the corrective disclosure at the end of the Class Period, thereby also satisfying the truth-on-the-market defense.[18] However, Mr. Keller did not undertake or provide any economic analysis or other economic rationale why investors would have subjectively understood the publicly available information exactly as he describes, let alone that they would have a full understanding of the alleged truth in this matter.[19] Nor does Mr. Keller fully understand how an efficient market operates, an issue I will explain in

[17] Nor does he provide any evidence that the impairment of $467 million of the Shenandoah asset, the expensing of $435 million of Shenandoah drilling costs, or the results of the Shen-6 sidetrack well had been disclosed prior to the May 2, 2017 disclosure (after the market closed). According to Plaintiffs, this was a partial disclosure of the alleged truth as the fraud remained undisclosed until the Fifth Circuit published a decision about whistleblower allegations in November 2019, after Occidental Petroleum Corporation acquired Anadarko and its common stock was no longer traded on the New York Stock Exchange ("NYSE").

[18] Keller Report, ¶19 (internal citation omitted).

[19] Keller Deposition at 48:2-7 ("Q. You didn't perform an – an event study; correct? A. I did not, no. Q. You didn't perform any other economic analysis? A. I did not.").

greater detail in the next section.[20] Finally, I have already tested the truth-on-the-market proposition and rejected it based on an event study, which shows that the residual price decline following the disclosure of the alleged truth in this case, after controlling for confounding factors, was statistically significant at the 1% level (*i.e.*, a higher level than typically used to demonstrate price impact).[21]

III. MR. KELLER'S FLAWED UNDERSTANDING OF MARKET EFFICIENCY

16. Mr. Keller states that his report will be used for Defendants' truth-on-the-market defense.[22] But to understand how the truth-on-the-market defense works, it is

[20] Among other things, one of the key cites Mr. Keller uses to describe market efficiency (quoted in the paragraph above) is actually characterizing strong-form efficiency, or a particular form of market efficiency in which prices also reflect private or inside information. There is no evidence that the market for Anadarko common stock was strong-form efficient. In fact, my event studies in this case demonstrate that it was not (*i.e.*, private information was not fully reflected in the stock price as evidenced by the price impact when previously private information was publicly disclosed). Steinholt Class Cert. Report, ¶¶36-45. At his deposition, Mr. Keller confirmed that he was using the strong-form definition of market efficiency. Keller Deposition at 27:12-15 ("So the – the version of market efficiency that you are relying on for your report is the strong form of market efficiency; correct? A. Yes.").

[21] Steinholt Report, ¶43.

[22] In fact, at his deposition, Mr. Keller claimed that he had proven Defendants' truth-on-the-market defense, Keller Deposition at 35:9-12 ("Do you believe that with your report you've proven the defendants' truth-on-the-market defense? A. I do."). This would be a remarkable accomplishment as Mr. Keller does not know what the Company knew internally. *Id.* at 101:11-14 ("And so, you didn't review any internal documents to determine what the company knew about Shenandoah; correct? A. That is correct."). Instead, he simply assumes that Defendants were truthful. *Id.* at 102:11-18 ("I'm assuming the statements that the company made were consensus – were – was the company's viewpoint on the then current situation, yes. Q. So you're – you're assuming that all of the statements by the company were true and accurate? A. Yes, I am.").

helpful to also have an understanding of what is meant when the term market efficiency is used in a fraud-on-the-market or truth-on-the-market context. In fact, I spent almost five pages in the Steinholt Class Cert. Report providing such context.[23] Unfortunately, Mr. Keller's explanation of an efficient market conflates a strict academic definition of an efficient market (which is a theoretical construct) with the relevant definition of an efficient market used in fraud-on-the-market and truth-on-the-market contexts, and which more accurately reflects how markets function in the real world.

17. Citing my report, Mr. Keller states that "Plaintiffs contend that Anadarko securities traded in an efficient market during the Class Period," a contention he does not dispute, but, in fact, assumes.[24] He then goes on to try to explain the general concept of market efficiency, presumably because it provides the economic basis for the truth-on-the-market defense. However, by explaining his understanding of the term market efficiency, he also reveals that his definition of an efficient market is different from the definition used in a fraud-on-the-market context, as explained in the Steinholt Class Cert. Report.[25]

18. Mr. Keller states that "[w]idely accepted financial theory posits that credible publicly available information, regardless of source, is reflected in the prices of securities that trade actively in public markets."[26] It is unclear what Mr. Keller means by "regardless

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[23] For a discussion of market efficiency in a fraud-on-the-market context, *see* the Steinholt Class Cert. Report, ¶¶12-18.

[24] Keller Report, ¶18.

[25] Steinholt Class Cert. Report, ¶¶12-18.

[26] Keller Report, ¶19.

of source," because the source of the information is not irrelevant to investors, and the credibility of the source of the information can have a significant impact on how the information is received by investors. If the information relates to an opinion, then a well-respected source will likely carry more weight than a less-respected source. In fact, if the source of some otherwise material information is an anonymous internet post, then the information may not impact the stock price at all. Conversely, with respect to information regarding Shenandoah, Anadarko, as the operator, would be viewed as having the most complete information regarding the resource. Consequently, information provided by Anadarko regarding Shenandoah generally would carry great weight.[27] In fact, in my opinion, Anadarko would generally be viewed as the primary source of information to the market regarding Shenandoah. Furthermore, companies that are publicly traded on the NYSE, as Anadarko was during the Class Period, have a legal obligation to provide truthful information. In my experience, the source of the information often plays an important factor in how investors weigh and, therefore, interpret the information.

19. Mr. Keller then states that the "reaction of stock prices to new information is 'instantaneous' in an efficient market."[28] This is only true when using the strict academic

[27] Mr. Keller also gave greater weight to Anadarko as a source, given that the Company was the operator. Keller Deposition at 162:19-22 ("I read this report and took it as one – one entity's opinion. But I certainly gave more weight to the fact that the operator [Anadarko] said it needed additional information before it could move forward.").

[28] Keller Report, ¶19.

definition of an efficient market, provided by Nobel laureate Eugene Fama.[29] However, as Fama himself explains, this is "an extreme null hypothesis [not expected] to be literally true":

> First, however, we should note that what we have called ***the*** efficient markets model in the discussion of earlier sections is the hypothesis that security prices at any point in time "fully reflect" ***all*** available information. Though we shall argue that the model stands up rather well to the data, ***it is obviously an extreme null hypothesis***. And, like any other extreme null hypothesis, ***we do not expect it to be literally true***.[30]

20. One reason that the price reaction to new information is not "instantaneous," or that securities prices do not at all times "'fully reflect' all available information," is that sophisticated investors need to have an economic incentive to first analyze information (*i.e.*, there has to be some degree of inefficiencies in the market for sophisticated investors to exploit to make them analyze the information, trade on it, and make money, a required activity necessary to eliminate the inefficiencies whenever they appear). This is called the Grossman-Stiglitz paradox.[31] To the extent it is Mr. Keller's opinion that the market for Anadarko's stock was so efficient that not even the most sophisticated investors could ever

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[29] Eugene Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, J. of Fin., Vol. 25, No. 2 (May 1970), at 383 ("A market in which prices always 'fully reflect' available information is called 'efficient.'").

[30] *Id.* at 388 (some emphasis added).

[31] Sanford J. Grossman & Nobel laureate Joseph E. Stiglitz, "On the Impossibility of Informationally Efficient Markets," *American Economic Review* 70 (June 1980) at 393-408 ("If competitive equilibrium is defined as a situation in which prices are such that all arbitrage profits are eliminated, is it possible that a competitive economy always be in equilibrium? Clearly not, for then those who arbitrage make no (private) return from their (privately) costly activity.").

profit from analyzing the publicly available information, something that generally is considered an "impossibility,"[32] then he should explicitly state so and perform an economic analysis to demonstrate that the market for Anadarko's common stock actually satisfies his definition.

21. Furthermore, as pointed out by one of the sources cited by Mr. Keller to define market efficiency, a market that is efficient as to the average investor may not be efficient as to the most sophisticated investors that Mr. Keller focuses on.[33] This is also recognized by various courts as they typically focus on "most investors," not the most sophisticated investors. For example, the U.S. Supreme Court decision in *Amgen Inc. v. Conn. Ret. Plans & Tr. Funds*, 568 U.S. 455 (2013), explained:

> "In *Basic*, we held that if a market is shown to be efficient, courts may presume that investors who traded securities in that market relied on public, material misrepresentations regarding those securities. This presumption springs from the very concept of market efficiency. If a market is generally efficient in incorporating publicly available information into a security's market price, it is reasonable to presume that a particular public, material misrepresentation will be reflected in the security's price. Furthermore, it is reasonable to presume that ***most investors*** – knowing that they have little hope of outperforming the market in the long run based solely on their analysis of publicly available information – will rely on the security's market

[32] *Id.*

[33] Aswath Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset*, John Wiley & Sons, Inc., at 113 (2d ed. 2002) ("Definitions of market efficiency have to be specific not only about the market that is being considered but also the investor group that is covered. It is extremely unlikely that all markets are efficient to all investors, but it entirely possible that a particular market (for instance, the New York Stock Exchange) is efficient with respect to the average investor."). Anadarko was listed and traded on the NYSE.

price as an unbiased assessment of the security's value in light of all public information."[34]

22. This same source cited by Mr. Keller also points out that "[d]efinitions of market efficiency are also linked up with assumptions about what information is available to investors and reflected in the price."[35] Specifically, it states that "[u]nder weak form efficiency, the current price reflects the information contained in all past prices," that "[u]nder semi-strong form efficiency, the current price reflects the information not only in past prices by all public information," and that "[u]nder strong form efficiency, the current price reflects all information, public as well as private."[36] Importantly, the relevant set of information used to define market efficiency in fraud-on-the-market cases is the semi-strong-form, which includes all publicly available information, but not private information (or internal information alleged to have been concealed from public investors by Defendants). Obviously, if the stock price reflected all available information, including all information Defendants knew internally, there would not be a fraud-on-the market case.

23. Mr. Keller does not appear to understand the distinction between private versus public information as he defines an efficient market as "one in which 'prices reflect all the information that can be acquired by painstaking analysis of the company and the

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[34] Steinholt Class Cert. Report, ¶15 (quoting *Amgen*, 568 U.S. at 461-62) (emphasis added). *See* Richard A. Brealey, *et al.*, *Principles of Corporate Finance*, at 330 (10th ed. 2011) ("[I]n an efficient market, there is no way for ***most investors*** to achieve consistently superior rates of return.") (emphasis added) (also cited in *Amgen*, 568 U.S. at 462).

[35] Damodaran, *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset*, at 113.

[36] *Id.*

economy.'"[37] However, this definition was specifically provided by the authors to explain strong-form efficiency, a definition of market efficiency in which the price would reflect the alleged truth regardless of whether the truth was part of the public mix of information or not.[38] At his deposition, Mr. Keller confirmed that he was using the strong-form definition of market efficiency.[39] This is improper. If the market for Anadarko was strong-form efficient, the Company's stock price would ***by definition*** not be impacted by concealing the alleged truth from public investors because the stock price would not only reflect the publicly available information, but also private information, including everything the Company knew internally.

IV. MR. KELLER'S REVIEW OF THE PUBLICLY AVAILABLE INFORMATION

24. The Keller Report is best understood as a review of the publicly available information that Defendants presumably, at some point, will use to try to argue that investors fully understood the alleged truth even if it was not disclosed by the Company, and that therefore, the ultimate disclosure of the alleged truth on May 3, 2017, did not cause Anadarko's stock price to decline, and, thus, did not cause any damages.

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[37] Keller Report, ¶19 (quoting Richard A. Brealey, *et al.*, *Principles of Corporate Finance*, McGraw-Hill, at 332 (12th ed. 2015).

[38] Richard A. Brealey, *et al.*, *Principles of Corporate Finance*, at 332 (12th ed. 2015). ("With strong market efficiency, prices reflect all the information that can be acquired by painstaking analysis of the company and the economy."). This is a later edition of the same textbook cited by the U.S. Supreme Court in *Amgen*, *see infra* fn 34. No changes were made to the above cited text from the 10th edition to the 12th edition.

[39] Keller Deposition at 27:12-15 ("So the – the version of market efficiency that you are relying on for your report is the strong form of market efficiency; correct? A. Yes.").

25. The Keller Report is 164 pages long and includes specific opinions regarding what Mr. Keller claims investors understood based on select documents at various points in time. Below I will review some of this publicly available information as it relates to my own analyses.

A. Anadarko's February 4, 2009, Announcement of the Shenandoah Discovery (Shen-1)

26. In the morning of February 4, 2009, Anadarko announced that the Shenandoah discovery well, Shen-1, had "encountered net oil pay approaching 300 feet in the Wilcox formation," and that "'[i]nitial data indicates the Shenandoah discovery has reservoir properties that appear to be of much higher quality than [the] industry has seen previously in the emerging Lower-Tertiary pay.'"[40]

27. According to Mr. Keller, with respect to this announcement, "investors understood that a discovery well is only the first step toward appraising any given resource," and that "[t]his process, which could take upwards of a decade, involves a significant amount of time and capital, and may not ultimately result in a FID."[41] Mr. Keller also claims that "[i]nvestors did not understand the announcement of Shen-1, which discussed net pay and reservoir properties, as a resource range."[42]

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[40] February 4, 2009, Anadarko press release, "Anadarko Announces Another Deepwater Gulf of Mexico Discovery."

[41] Keller Report, ¶120.

[42] *Id.*, ¶121.

28. It is unclear how Mr. Keller would know what specific investors knew, or why the issues he focuses on would be the actual key takeaway for investors from the information disclosed by the Company. Mr. Keller appears to try to downplay the importance of the Shenandoah discovery. However, typically, with respect to new information that may be expected to increase (as opposed to simply maintain) investors' expectations, experts will use an event study to determine whether investors collectively viewed the information as material. Using an event study, I determined that following Anadarko's announcement of the Shenandoah discovery, the Company's residual stock price increase was 4.7% on February 4, 2009, which translates into an increase of more than $800 million in Anadarko's market capitalization, and was statistically significant at the 1% level (*i.e.*, a higher benchmark than that generally used to demonstrate price impact).[43] Based on the event study, it is my opinion that the consensus among investors was that Shenandoah was a significant resource that had substantial value following the announcement of the Shenandoah discovery, as evidenced by the statistically significant price increase translating into an increase of $800 million in Anadarko's market capitalization.

[43] Based on an event study using the S&P 500 as a proxy for market factors, and an equally weighted index of Apache Corporation, Chesapeake Energy Corporation, Chevron Corporation, Devon Energy Corporation, EOG Resources, Inc., Hess Corporation, Noble Energy, Inc., Occidental Petroleum Corporation, and Pioneer Natural Resources Company as a proxy for industry factors. Control period 252-trading days (or approximately one-year) prior to February 4, 2009 and the resulting t-statistic was 2.7.

B. Anadarko's Announcement of Shen-2

29. On March 19, 2013, after the market closed, Anadarko announced that the Shen-2 appraisal well had encountered more than 1,000 net feet of oil pay, and stated that the Shenandoah field represented "'one of Anadarko's largest oil discoveries in the Gulf of Mexico,'" that "'Anadarko is strategically positioned in the Shenandoah Basin, which has the potential to become one of the most prolific new areas in the deepwater Gulf of Mexico,'" and that the Company was "'incorporating the information obtained from [Shen-2] into [its] planning and anticipate further appraisal drilling to advance this potentially giant project.'"[44] It should be noted that the term "giant" project is commonly used to characterize a resource greater than 500 MMboe.[45]

30. According to Mr. Keller, "[i]nvestors did not view Anadarko's March 2013 statement announcing the results of Shen-2 as an estimate of the projected value and size of Shenandoah."[46] Furthermore, he opined that "[i]nvestors understood that there would be additional appraisal drilling following Shen-2," and that "[i]nvestors understood that the appraisal program was in its early stages, and that any development would depend on the

[44] March 19, 2013, Anadarko press release, "Anadarko Announces Shenandoah Appraisal Well Encounters More Than 1,000 Net Feet of Oil Pay."

[45] Keller Deposition at 189:2-11 ("So that refreshes your recollection that giant field refers to 500 MMBOE – A. Yes. Q. – EUR. A. Yes. Q. Okay. So that – that's not gross, that's recoverable – A. Estimated – Q. – right? A. – ultimate – yes.").

[46] Keller Report, ¶127.

findings of the appraisal program, cost of development, and macroeconomic factors such as the price of oil."[47]

31. Again, it is unclear how Mr. Keller would know what specific investors knew, or why the issues he focuses on would be the actual key takeaway for investors from the information disclosed by the Company. Mr. Keller again appears to try to downplay the success of Shen-2, contrary to the evidentiary record. A March 19, 2013, Bank of America analyst report stated that Anadarko "has announced the results [of Shen-2] – and it looks huge."[48] A March 20, 2013, J.P. Morgan analyst report further explained, "[a]lthough [Anadarko] has not provided an overall estimated resource size, the press release calls Shenandoah a 'potentially giant project.'"[49] Another March 20, 2013, analyst report by Barclays had the headline: "Shenandoah appraisal well encounters 1000+ net pay; We speculate size of discovery could be 300-1700 mmboe gross, perhaps worth $5-25 per share."[50] A March 20, 2013, Credit Suisse analyst report responded to the Shen-2 announcement by stating that, "[i]mportantly, the discovery appears larger than our base case estimate of 340 MMBoe as the appraisal well found more than 1,000 net feet of oil

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[47] *Id.*, ¶¶129, 130.

[48] March 19, 2013, Bank of America analyst report on Anadarko, "Shenandoah: major discovery confirmed valued at ~$4/share."

[49] March 20, 2013, J.P. Morgan analyst report on Anadarko, "More Success in the Deepwater GoM; Shenandoah-2 Encounters > 1,000 Net Feet of Oil Pay and No Oil-Water Contact."

[50] March 20, 2013, Barclays analyst report on Anadarko, "Shenandoah appraisal well encounters 1000+ net pay; We speculate size of discovery could be 300-1700 mmboe gross, perhaps worth $5-25 per share."

pay," and that they believed "the market could initially price in a 400 to 550 MMBoe discovery range, which [they] estimate[d] [was] worth $1.97 to $2.64 per [Anadarko] share."[51]

32. Generally, with respect to new information that may be expected to increase (as opposed to simply maintain) investors' expectations, experts will use an event study to determine whether the potential increase was material. Using an event study, I determined that following Anadarko's announcement of the Shenandoah discovery, the Company's residual stock price increase was 3.7% on March 20, 2013, which translates into an increase of more than $1.5 billion in Anadarko's market capitalization, and was statistically significant at the 1% level (*i.e.*, a higher benchmark than that generally used to demonstrate price impact).[52] Based on the event study, it is my opinion that the consensus among investors was that Shenandoah was a significant resource that had substantial value following the Shen-2 announcement, as evidenced by the statistically significant price increase translating into an increase of $1.5 billion in Anadarko's market capitalization.

[51] March 20, 2013, Credit Suisse analyst report on Anadarko, "Shenandoah: A Doozey of a Discovery Indeed."

[52] Based on an event study using the S&P 500 as a proxy for market factors, and an equally weighted index of Apache Corporation, Chesapeake Energy Corporation, Chevron Corporation, Devon Energy Corporation, EOG Resources, Inc., Hess Corporation, Noble Energy, Inc., Occidental Petroleum Corporation, and Pioneer Natural Resources Company as a proxy for industry factors. Control period 252-trading days (or approximately one-year) prior to March 20, 2013 and the resulting t-statistic was 3.9.

C. Anadarko's Announcement of Shen-3

33. On February 2, 2015, Anadarko reported its results for 4Q2014 and FY2014, and also announced that the "[a]ppraisal activity . . . in the Gulf of Mexico at the Shenandoah discovery continued to validate the company's geologic models around these apparent commercial discoveries."[53] On the conference call following the earnings release, on February 3, 2015, Anadarko's head of Deep-Water Exploration, Defendant Robert P. Daniels, stated that based on pressure data, the Company was able to project up the oil-water contact. He stated:

> At Shenandoah, I'll start there, we are so excited about what we are seeing there. ***We've got very good results for what we set out to do at the most recent appraisal well***.
>
> * * *
>
> So overall, we are looking to understand the oil in place better, and the potential recovery mechanisms. And if you look at the results, we really did all of that. We have excellent lateral sand continuity. . . .
>
> ***The oil/water contacts were not encountered in the well. But based on the pressure data, we were able to project those up***. So we got a much better handle on the oil in place, and that has expanded, with more confidence on it. So that was a very positive thing.
>
> Reservoir quality was good, so that gives us a lot of confidence on the potential for the water drive.[54]

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[53] February 2, 2015, Anadarko press release, "Anadarko Announces 2014 Fourth-Quarter and Full-Year Results."

[54] February 3, 2015, Anadarko conference call, "Q4 2014 Anadarko Petroleum Corp Earnings Call," at 7 (emphasis added). On the March 3, 2015, conference call, Defendant Daniels repeated that Shen-3 was a successful appraisal well. March 3, 2015, Anadarko conference call, "Anadarko Petroleum Corp 2015 Capital Program and Guidance Call," at 11 ("We're excited about the advancement at Shenandoah. We pushed down dip on [Shen-3], searching for the oil/water contact, looking for reservoir continuity and quality, and to

34. On February 13, 2015, *Upstream Online* published an article in which Defendant Daniels further stated that, among other things, Shen-3 "expanded" the oil in place. It stated:

> Anadarko will continue to appraise the field that has been touted as possibly one of the biggest discoveries in the US Gulf in recent memory. The first appraisal well, drilled in 2013, revealed a pay column about 1000 feet thick and inspired talk of "multiple" potential installations.
>
> However, the most recent well, Shenandoah-3, left many observers scratching their heads.
>
> ConocoPhillips, a partner in the well, said it had expensed the appraisal probe, a test about 1500 feet down dip and 2.3 miles (3.7 kilometres) east of [Shen-2].
>
> Some analysts took that to mean the well was a bust, but Anadarko executives cast it in a much more positive light.
>
> "We are so excited about what we are seeing there," said Robert Daniels, Anadarko's head of deep-water exploration.
>
> He said the company wanted to gauge the sand continuity and possible down-dip thickening of the reservoir.
>
> They were also looking to establish an oil-water contact and to better understand the reservoir quality and potential recovery mechanism. "If you look at the results, we really did all of that," Daniels said.
>
> "We had excellent lateral sand continuity and the packages are all present.
>
> "***The oil-water contacts were not encountered in the well, but based on the pressure data we were able to project those up***.
>
> "So we got a much better handle on the ***oil in place, and that has expanded, with more confidence on it***."

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get a core in the down dip portions of the reservoir. ***This was a very successful appraisal well***.") (emphasis added).

* * *

> Daniels did acknowledge that recent results probably reduce the upper end of the aerial extent of Shenandoah, "but it is not a very significant reduction."[55]

35. On February 20, 2015, after the market closed, Anadarko filed its annual Form 10-K with the SEC, stating that Shen-3 "finished drilling at the end of 2014 and found approximately ***50% (1,470 feet) more of the same reservoir sands*** 1,500 feet down-dip and 2.3 miles east of the [Shen-2] well, which encountered over 1,000 feet of net oil pay in excellent quality Lower Tertiary-aged sands," and that the Shen-3 well "confirmed the sand depositional environment, lateral sand continuity, excellent reservoir qualities, and down-dip thickening [and] also enabled the ***projection of oil-water contacts*** based on pressure data and ***reduced the uncertainty of the resource range***."[56]

36. Mr. Keller does recognize that Anadarko (as well as Shenandoah partner Cobalt) "viewed Shen-3 as successful."[57] However, he also opines that "investors understood that Shen-3 (1) did not encounter hydrocarbons, (2) reduced the areal extent of the hydrocarbon bearing portion of the reservoir, and (3) likely reduced the potential resources."[58]

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[55] February 13, 2015, *Upstream Online*, "Anadarko mulling over its options at Shenandoah."

[56] Anadarko 2014 Form 10-K, filed with the SEC on February 20, 2015, at 9 (emphasis added).

[57] Keller Report, ¶208.

[58] *Id.*, ¶210. Mr. Keller also opined that the market understood additional wells were needed in order to understand the Shenandoah resource potential. *Id.*, ¶219.

37. Again, Mr. Keller offers no sound methodology for his opinion about what specific investors knew, or why the issues he focuses on would be the key takeaway for investors from all the information disclosed by the Company. Mr. Keller's opinion is also contradicted by the record. For example, a February 3, 2015, Bank of America analyst report stated that "Shenandoah gets bigger. The [Shen-3] appraisal well encountered ~50% (1,470 ft) more of the same reservoir down-dip and drilled 2.3 miles east of the [Shen-2] well that had found over 1,000 ft of net oil pay. We believe this helps to further validate this as 500mm - 1bn boe discovery."[59] Similarly, following the Shen-3 announcement, a February 3, 2015, Heikkinen Energy Advisors research note concluded: "We estimate Shenandoah is a 750MMboe discovery given 1,000' of net oil pay and identifying the confirmed oil-water contact from pressure data."[60]

38. In any event, Mr. Keller's subjective interpretation still does not mean that investors knew that Shenandoah was unlikely to be commercially viable,[61] or that investors did not attribute significant value to Shenandoah. In fact, a February 2, 2015, Capital One analyst report cited by Mr. Keller that seems to have shared his view that Shen-3 was an "unsuccessful well [that] likely condemns at least some of the southeastern flank of the

[59] February 3, 2015, Bank of America analyst report on Anadarko, "4Q14 results recap: 'preserve value, don't chase growth.'"

[60] February 3, 2015, Heikkinen Energy Advisors research note (APC-00159676-79).

[61] Steinholt Report, ¶28(j).

structure's aerial extent," also attributed $1.8 billion to $3.6 billion (or $4 per share to $7 per share) in potential value to Shenandoah.[62]

39. Other analyst reports also attributed substantial value to the Shenandoah resource at the beginning of the Class Period. For example, a March 3, 2015, Morgan Stanley analyst report valued Anadarko's interest in Shenandoah at $1.7 billion (or $3 per share).[63] An April 9, 2015, Imperial Capital analyst report valued Anadarko's interest in Shenandoah at $3 billion (or $5.81 per share).[64] Different analysts interpreted the publicly available information differently and came up with different valuations of Shenandoah. That said, while analysts may have differed in their valuations, the evidentiary record shows that analysts viewed Shenandoah as substantially contributing to Anadarko's value following Shen-3.[65]

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[62] February 2, 2015, Capital One analyst report on Anadarko, "Morning Energy Summary" (not included in Keller Report, Figure 8) ("We have been carrying Shenandoah as a 1 billion boe discovery in our APC model (300 MMboe net to APC's 30% WI, worth ~$3.6B or ~$7 per share). While it still could ultimately be that large, we think it's prudent to cut our resource estimate in half for now to 500 MMboe. We are thus cutting our NAV by $3 to $99.").

[63] March 3, 2015, Morgan Stanley analyst report on Anadarko, "Anadarko Petroleum Corp NAm Shines, Positioned to Lead Recovery" (also included in Keller Report, Figure 8).

[64] April 9, 2015, Imperial Capital analyst report on Anadarko (also included in Keller Report, Figure 8).

[65] Not all analysts provided a stand-alone value for Shenandoah in their NAV estimate. However, this does not mean that they believed the value was zero. As noted in a December 9, 2015 J.P. Morgan analyst report: "Under our conservative NAV methodology, we only give value in our NAV for projects where there is a definitive sight-line toward project sanction and development. If these projects are successfully appraised [the Shenandoah being one of them], there is upside risk to our NAV forecast." December

D. Anadarko's Announcement of Shen-4

40. On October 27, 2015, Anadarko announced that it had "[c]ompleted a successful appraisal test [Shen-4 appraisal well] at the Shenandoah field in the Gulf of Mexico," and that Shen-4 had "encountered more than 620 net feet of oil pay."[66] The following day, on October 28, 2015, Anadarko held a conference call on which Defendant Daniels stated:

> The reservoir quality in the initial assessment looks pretty – well it looks comparable to everything else we've found out there. So very good reservoir quality.
>
> * * *
>
> [W]e're very encouraged with what we saw, and it was all well within the range of expectation of what we had put out there.[67]

41. According to Mr. Keller, following the announcement of Shen-4, investors understood that the original Shen-4 encountered salt, that the sidetrack well encountered less pay than Shen-2, and that additional wells would be needed to better understand the size and quality of the east side of the prospect.[68] Again, it is unclear how Mr. Keller would

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9, 2015, J.P. Morgan analyst report on Anadarko, "Initiate at Neutral; Sidelines for Now on LNG 'Air Pocket.'"

[66] October 27, 2015, Anadarko press release, "Anadarko Announces Third-Quarter 2015 Results."

[67] October 28, 2015, Anadarko conference call, "Q3 2015 Anadarko Petroleum Corp Earnings Call," at 5-6.

[68] Keller Report, ¶¶232-234.

know what specific investors knew, or why these issues would be the key takeaway for investors from all the information disclosed by the Company.

42. Furthermore, Mr. Keller's subjective interpretation still does not mean that investors knew that Shenandoah was not commercially viable,[69] or that investors did not attribute significant value to Shenandoah. For example, in an October 28, 2015, analyst report, RBC Capital Markets stated that Shen-4 "successfully encountered more than 620 net feet oil pay, extending to the lowest known oil column," and that this "could portend increasing the resource potential in the basin."[70] An October 28, 2015, Deutsche Bank analyst report stated that "GoM exploration results mostly positive as [Shen-4] sidetrack appraisal well encountered 620 feet of net oil pay."[71] An October 28, 2015, Wolfe Research analyst report valued Anadarko's interest in Shenandoah at $1.1 billion (or $2.09 per share).[72] An October 28, 2015, UBS analyst report valued Anadarko's interest in Shenandoah at $1.4 billion (or $2.75 per share).[73]

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[69] Steinholt Report, ¶28(j).

[70] October 28, 2015, RBC Capital Markets analyst report on Anadarko, "Onshore Oil Growth Assets Outperform."

[71] October 28, 2015, Deutsche Bank analyst report on Anadarko, "Mixing the short and the long game."

[72] October 28, 2015, Wolfe Research analyst report on Anadarko, "Anadarko before the dawn" (also included in Keller Report, Figure 8).

[73] October 28, 2015, UBS analyst report on Anadarko, "3Q CFPS Beats on Lower Costs; Modestly Raises Divestiture Adjusted Production Guidance" (also included in Keller Report, Figure 8).

43. Mr. Keller also opines that, after the results of Shen-4 were released, investors understood that Anadarko was unlikely to invest in Shenandoah at then-prevailing oil prices, which at the time was in the low- to mid- $40s.[74] However, his earliest citation is to the Company's February 2, 2016 conference call months later, with Anadarko's CEO, Defendant R.A. Walker, "saying they were 'not drilling with a view that we would develop Shenandoah in a $30 price environment' . . . [adding] that he felt Shenandoah and other long-term projects 'today, are worthy of spending capital, expecting that oil is not going to be at $30 for the rest of our life.'"[75] As such, the statement was later in time and related to oil at $30, compared to the prevailing oil price of approximately $50 when Anadarko wrote off Shenandoah. In any event, it is again unclear how Mr. Keller would know what specific investors knew.

44. Furthermore, Mr. Keller's subjective interpretation still does not mean that investors knew that Shenandoah was not commercially viable,[76] or that investors did not attribute significant value to Shenandoah following the February 2016 statement. In fact, an April 11, 2016, Simmons & Company analyst report, valued Anadarko's interest in Shenandoah at $1.3 billion (or almost $2.50 per share).[77]

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[74] Keller Report, ¶235.

[75] *Id.*, ¶259.

[76] Steinholt Report, ¶28(j).

[77] April 16, 2016, Simmons & Company analyst report on Anadarko, "Partner Sells Down Shenandoah Working Interest," not included in Keller Report, Figure 8.

45. Finally, Mr. Keller opines that, by no later than May 2016, investors understood that there was faulting in the Shenandoah basin (including faults between Shen-2 and Shen-3, and between Shen-2 and Shen-4), which required Anadarko to continue drilling to understand the asset.[78] Again, it is also unclear how Mr. Keller would know what specific investors knew. Furthermore, there is also specific analyst reports that indicate that the complexities of Shenandoah were not understood until after the corrective disclosure. For example, a May 3, 2017 email from Alyson McCaffrey of Tudor, Pickering, Holt & Co. cited the firm's view that they "like the fundamentals for [Anadarko] but would be getting in front of Shenandoah, as reservoir looks more complex than originally thought."[79] Similarly, a May 18, 2017, Societe Generale analyst report stated that "[d]uring 1Q17, [Anadarko] did impair Shenandoah for $435 million, given the #6 well's results," and that "[i]t appears to us to be a much more compartmentalized structure than first thought."[80]

46. Again, different analysts interpreted the publicly available information differently and came up with different valuations of Shenandoah. That said, the evidence above shows that analysts viewed Shenandoah as substantially contributing to Anadarko's value following the announcement of Shen-4.

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[78] Keller Report, ¶264.

[79] LA-APCSUB-011872.

[80] May 18, 2017, Societe Generale analyst report on Anadarko, "Stock at 10 month low, cash represents 20% of market value. Headline risk overdone."

E. Anadarko's Announcement of Shen-5

47. On July 26, 2016, after the market closed, Anadarko announced that the Shen-5 appraisal well had "[e]ncountered more than 1,040 net feet of oil pay," and that it had increased its working interest in Shenandoah from 30% to 33%.[81] On the conference call the next day, Defendant Walker stated that "we were real pleased with what we saw in the number 5 well . . . very pleased to see it come in as we had predicted it would."[82]

48. According to Mr. Keller, following the announcement of Shen-5, investors understood that any financial investment decision ("FID") would depend on the results of Shen-6, and the ability to reduce development costs, and commodity prices.[83] Again, it is unclear how Mr. Keller would know what specific investors knew, or why these issues would be the key takeaway for investors from the information disclosed by the Company. Moreover, contrary to Mr. Keller's claim, it is my understanding that, according to the evidence, senior management decided to write off Shenandoah before the results of Shen-6 were known.[84]

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[81] July 26, 2016, Anadarko press release, "Anadarko Announces Second-Quarter 2016 Results."

[82] July 27, 2016, Anadarko conference call, "Q2 2016 Anadarko Petroleum Corp Earnings Call," at 5.

[83] Keller Report, ¶¶278.

[84] Deposition Exhibit 303 at APC-00290059; Deposition Exhibit 274 at APC-00307805.

49. Furthermore, Mr. Keller's subjective interpretation still does not mean that investors knew that Shenandoah was not commercially viable,[85] or that investors did not attribute significant value to Shenandoah. In fact, a July 27, 2016, KLR analyst report stated that a "sanctioned Shenandoah development should constitute approximately $5 per share of incremental fair value."[86] A July 27, 2016, UBS analyst report stated that Shen-5 "confirms the discovery is the 'finest lower tertiary discovery to date,'" and valued Anadarko's interest in Shenandoah at approximately $790 million (or $1.55 per share).[87] A July 27, 2016, Wolfe Research analyst report valued Anadarko's interest in Shenandoah at $956 million (or $1.88 per share).[88]

50. Again, different analysts interpreted the publicly available information differently and came up with different valuations of Shenandoah. That said, the evidence above shows that analysts viewed Shenandoah as substantially contributing to Anadarko's value following the Shen-5 announcement.

F. Shen-6 Appraisal Well

51. According to Mr. Keller, investors understood before Anadarko's alleged partial corrective disclosure (after the market closed on May 2, 2017) that Shen-6 was

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[85] Steinholt Report, ¶28(j).

[86] July 27, 2016, KLR analyst report on Anadarko, "Slightly Higher U.S./Algerian Liquids Production Trajectory."

[87] July 27, 2016, UBS analyst report on Anadarko, "APC 2Q Beats, Raises Production Guidance, and Boosts Divestiture Target" (also included in Keller Report, Figure 8).

[88] July 27, 2016, Wolfe Research analyst report on Anadarko, "If you'll be my bodyguard" (also included in Keller Report, Figure 8).

wet.[89] This is an imprecise statement as it fails to distinguish between the Shen-6 appraisal well and the Shen-6 sidetrack well. As I noted in the Steinholt Class Cert. Rebuttal, a May 3, 2017, Cowen analyst report on Cobalt stated that "Anadarko put out disappointing news yesterday afternoon [May 2, 2017] with respect to Shenandoah," but the report also explained that the "fact that the appraisal well was a disappointment became apparent in March," while the "sidetrack well results is new news and we believe [the sidetrack well being dry] will be a disappointment."[90]

52. As support for his opinion, Mr. Keller cites ConocoPhillips (another Shenandoah partner) 2016 Form 10-K (filed with the SEC on February 21, 2017) stating that the Shen-6 reached total depth in February 2017, and that a sidetrack well also commenced in February.[91] He also cites a Cobalt March 14, 2017 earnings call discussing Shen-6 encountering water, or being dry, clearly referring to the Shen-6 appraisal well and not the Shen-6 sidetrack well that had not been drilled yet.[92] This is consistent with the May 3, 2017, Cobalt report I cited in the prior paragraph. Again, it is unclear how Mr. Keller would know what specific investors knew about Shen-6 in February and March of 2017.

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89 Keller Report, ¶317.

90 May 3, 2017, Cowen analyst report on Cobalt, "Shenandoah Results A Negative."

91 Keller Report, ¶318.

92 *Id.*, ¶319.

53. As Mr. Keller conceded, even if Shen-6 was dry, this would not necessarily mean that the appraisal activities at Shenandoah would end.[93] Instead, Mr. Keller appears to have the incorrect understanding that ConocoPhillips wrote off Shenandoah prior to the end of the Class Period, and, thereby, also revealed the suspension of appraisal activities at Shenandoah.[94] This is an incorrect understanding of the facts. ConocoPhillips did take a $101 million dry hole expense, an undisclosed portion of which included Shen-6, before the market closed on May 2, 2017. However, ConocoPhillips did not write off Shenandoah until May 4, 2017, a $242 million dry hole expense and a $51 million leasehold impairment that was "Based on Subsequent Partner [Anadarko] Disclosures and Information" (*i.e.*, the corrective disclosure).[95] In other words, ConocoPhillips did not write off Shenandoah on May 2, 2017, and, consequently, did not reveal the write off, nor the suspension of

[93] Keller Deposition at 202:7-13 ("Q. Okay. But the company never said Shen 6 was the end of the line, did it? A. It said continuation would be dependent on 5 and then on 6. I never heard mention of 7, so no. Q. In other words, it – it didn't say that was going to be the end of its appraisal program? A. That – that is correct.").

[94] *Id.* at 36:23-37:17 ("Are you opining that Anadarko's decision to suspend its appraisal of Shenandoah was publicly known before close of market on . . . May 2nd, 2017? A. It was first disclosed as a fact by Conoco in its write-off. Okay, yes, correct. Q. Do you mean Anadarko? You said Conoco. A. Well, Conoco announced the write-off . . . the day before Anadarko was suspended. Q. Okay. So you're saying that ConocoPhillips said . . . that appraisal activities were being suspended at Shenandoah before close of market on May 2nd, 2017? Is that your testimony? A. That's . . . my recollection, yes. Q. That's your testimony? A. That's my recollection, yes. Q. Under oath? A. Yes.").

[95] May 4, 2017, ConocoPhillips press release, "ConocoPhillips Provides Update to First-Quarter 2017 Results Based on Subsequent Partner Disclosures and Information."

Shenandoah appraisal activities, to investors prior to the end of the Class Period. Mr. Keller's understanding of the facts is simply wrong.

54. Furthermore, Mr. Keller's subjective interpretation still does not mean that investors knew that Shenandoah was not commercially viable,[96] or that investors did not attribute significant value to Shenandoah. In fact, a March 13, 2017, Wolfe Research analyst report valued Anadarko's interest in Shenandoah at approximately $1.3 billion (or $2.37 per share);[97] and a March 16, 2017, RBC Capital Markets analyst report valued Anadarko's interest in Shenandoah at $953 million (or $1.71 per share).[98] These were also the last two valuations included in Figure 8 in the Keller Report prior to the end of the Class Period. In addition, not included in Figure 8 of the Keller Report is the analysis performed by Class Representative Norfolk County Council as Administering Authority of the Norfolk Pension Fund's investment manager, valuing Shenandoah at $2.28 billion, or $4.11 per share, as of April 4, 2017.[99]

55. Again, different analysts interpreted the publicly available information differently and came up with different valuations of Shenandoah, as evidenced in Figure 8

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[96] Steinholt Report, ¶28(j).

[97] March 13, 2017, Wolfe Research analyst report on Anadarko, "Mr. Misunderstood (I understand)" (also included in Keller Report, Figure 8).

[98] March 16, 2017, RBC Capital Markets analyst report on Anadarko, "The Plan Has Come Together" (also included in Keller Report, Figure 8).

[99] SARASIN0000058.

of the Keller Report. That said, the evidence above shows that analysts viewed Shenandoah as substantially contributing to Anadarko's value during the Class Period.

G. After Market May 2, 2017 Corrective Disclosure of the Alleged Truth

56. On May 2, 2017, after the market closed, Anadarko disclosed for the first time that: (a) it was suspending appraisal activities of Shenandoah; (b) it was recognizing $467 million of impairments related to Shenandoah; (c) it was expensing exploratory well costs of $435 million related to Shenandoah; and (d) the Shen-6 sidetrack well was dry.

57. According to Mr. Keller, "[m]arket participants' reactions to Anadarko's decision to suspend Shenandoah reflect that investors understood before the write-off that Anadarko was unlikely to sanction Shen-6."[100] To support his opinion, Mr. Keller selectively cites four analyst reports (out of at least 26 issued on May 2-3, 2017), none which says investors understood prior to Anadarko's suspension of appraisal activities at Shenandoah that the Company was unlikely to sanction Shen-6.

58. The first, J.P. Morgan, simply references the fact that the Shen-6 appraisal well was unsuccessful, and that Anadarko had decided to suspend appraisal activity, but did not comment on what investors understood or whether the Shenandoah news was a surprise.[101]

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[100] Keller Report, ¶324.

[101] *Id.*, ¶328(a) ("J.P. Morgan: 'As previously highlighted by its partners, the Shenandoah-6 appraisal well designed to test the oil-water contact on the eastern edge of the field was unsuccessful, and APC has decided to suspend appraisal activity at the field.'").

59. The second, Evercore, noted its view that the write down was not "completely unexpected," but did not comment on what investors understood or whether the Shenandoah news was a surprise.[102]

60. The third, Goldman Sachs, noted its understanding that Anadarko was unlikely to pursue Shenandoah at current oil prices consistent with previous commentary, but does not comment on what investors understood. With respect to the more relevant inquiry, whether the Shenandoah disclosure was new and material information, however, the next sentence (not cited by Mr. Keller) states that Goldman Sachs "lower[ed] [its] NAV by $1/shs associated with the Shenandoah prospect," indicating that Goldman Sachs actually did attribute significant value to Shenandoah prior to the corrective disclosure and changed its view following the disclosure.[103]

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[102] *Id*., ¶328(b) ("Evercore: 'Transitions in E&P are challenging, and in many ways 1H17 was likely to prove the apex of the transition for APC. Integrating disparate assets in the Gulf of Mexico (a challenging operating environment, particularly when energy investors crave predictability), completing major asset divestitures which muddle a clear view of the go forward asset base, and transitioning to growth from the core of the US onshore (Delaware) where big growth off a small base will be needed to drive corporate level results were the hurdles. Add to this headlines and fears surrounding a tragic residential explosion two weeks ago in CO that saw APC preemptively shut-in legacy production in the region, a bumpy 2Q oil guide driven by outages and tie-ins in the GoM, and a massive (not completely unexpected) write down at Shenandoah all suggest 1Q was likely a perfect storm of negatives for the stock. . . . Today's update included several notable datapoints in the GoM, including the integration of FCX, strong performance from Caesar/Tonga, and success at Calpurnia. While we (and the street) had viewed as heavily risked, APC announced the Shenandoah-6 appraisal well did not encounter the oil-water contact and recorded a one-time GoM-related impairment of over $500mm ($467mm Shenandoah).'").

[103] May 3, 2017, Goldman Sachs analyst report on Anadarko, "On track to meet 2017 outlook; lower asset sale proceeds negative" ("Tie-back opportunity from existing infrastructure in Gulf of Mexico remains robust; greenfield Shenandoah development unlikely. APC continues to see robust performance from wells that can be tied-back to

61. The fourth, Cowen, simply stated that it did not give Anadarko any value for Shenandoah, but does not comment on what investors understood.[104] With respect to whether the Shenandoah disclosure was a surprise, however, not included by Mr. Keller's discussion is that the Cowen analyst covering Cobalt stated that "[w]e and our equity colleague . . . who covers Anadarko, both believe that Anadarko put out disappointing news yesterday afternoon with respect to Shenandoah," indicating that they believed the Shenandoah news was a negative surprise.[105]

62. Many other analysts also commented on the Shenandoah news being a negative and a surprise, evidence Mr. Keller ignores altogether, including:

(a) A Bernstein analyst report stated that "[i]n the DW GOM, some tie-back success was overshadowed by a large Shenandoah impairment ($467 mln) and dry hole expensing ($435 mln). Note the negative read-across to [Cobalt International]."[106]

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existing infrastructure in GOM. APC continues to enhance GOM tie-back opportunity: (1) Calpurnia exploration well encountered 60 net feet of oil pay; and (2) APC successfully bid on 16 blocks near existing platforms. Following unfavorable result from the Shenandoah well, APC is unlikely to pursue development of the project at current oil prices (consistent with previous commentary). ***We lower our NAV by $1/shr associated with the Shenandoah prospect***."). Emphasized sentence was left out of Mr. Keller's cite. Keller Report, ¶328(c).

[104] Keller Report, ¶328(d) ("Cowen: 'Shenandoah-6 appraisal well and subsequent sidetrack did not encounter oil water contact on eastern portion of the field. APC has currently suspended appraisal activity and wrote down the entire Shenandoah prospect which notably impacted 2Q17 EPS. We did not give APC any value for Shenandoah in our model. Focus in GOM now turns to tiebacks in our view.'").

[105] May 3, 2017, Cowen analyst report on Cobalt, "Shenandoah Results A Negative."

[106] May 2, 2017, Bernstein analyst report on Anadarko, "Quick Take (APC): APC may suffer overhang on Firestone and Shenandoah but remember the 3D vision with Delaware in focus."

(b) An RBC Capital Markets analyst report stated that the Shenandoah disclosure "could cause some market concern."[107]

(c) A Johnson Rice analyst report stated that "[t]he negative development is an unsuccessful appraisal well at Shenandoah."[108]

(d) An Atlantic Equities analyst report led with the headline "Shenandoah field write-off overshadows results" and stated that "Shenandoah was a high profile discovery which was considered to have potential to be a significant source of new production."[109]

(e) A Societe Generale analyst report stated that "[t]he only GOM DeepH20 negative was Shenandoah 6, which was a dry hole and has caused APC to suspend appraisal activity."[110]

(f) A Macquarie analyst report stated that "longer term growth is growing increasingly elusive, especially if an already discovered project like Shenandoah is not deemed economic."[111]

(g) A Wolfe Research analyst report stated that the suspension of the Shenandoah "does take away from APC's premium for exploration, which is gone, and no longer in our price target."[112]

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[107] May 2, 2017, RBC Capital Markets analyst report on Anadarko, "Market Focus May Be Elsewhere" ("Core results look good but results at Shenandoah and the well incident in the DJ could cause some market concern.").

[108] May 2, 2017, Johnson Rice & Co. analyst report on Anadarko, "Sales Note: Noisy Quarter on Divestments; 2Ql7 Guide Light, but 2017 Intact."

[109] May 3, 2017, Atlantic Equities analyst report on Anadarko, "Shenandoah field write-off overshadows results."

[110] May 3, 2017, Societe Generale analyst report on Anadarko, "1Q17 Adjusted EPS Miss. Now 55% oil leveraged. Post asset sales, $10.58/share in cash."

[111] May 3, 2017, Macquarie analyst report on Anadarko, "Where Do We Go From Here?"

[112] May 3, 2017, Wolfe Research analyst report on Anadarko, "Mr. Misunderstood – Always left out, never fit in."

(h) Citi cut its rating for Cobalt to sell from neutral as a result of Anadarko suspending further appraisal work at Shenandoah.[113]

(i) Bernstein cut its target price for Cobalt from $2.00 per share to $1.20 per share, citing "Anadarko's disclosures effectively halting development of the Shenandoah field."[114]

63. Similarly, a May 3, 2017 Lazard Asset Management report stated:

> Deepwater Gulf of Mexico has shifted from being a positive to a problem. The decision to impair Shenandoah (to the tune of ~$1bn) was surprising given that APC had already drilled five appraisal wells. While APC has not yet decided to relinquish the leases, it appears that management has little confidence that the project will move forward. This in turns removes an expected source of future production (and cash flow), and it raises questions about APC's ability to find new tie-back developments for its significant infrastructure in the Gulf. Unexpectedly, CEO Al Walker opined on the call that "at $50-60 oil, Gulf of Mexico development is challenged." Worrying given oil is sub-$50 today.[115]

64. Again, different analysts interpreted the publicly available information differently, and how analysts interpreted the information may be different than how investors interpreted or understood the information. For example, one analyst may recommend "buy" while another recommends "sell." Likewise, some investors buy while others sell.

65. As a result of the above varying opinions, the proper methodology to analyze how investors collectively reacted to Anadarko's corrective disclosure is an event study.

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[113] May 3, 2017, *Bloomberg*, "Cobalt Intl Cut at Citi as Anadarko Suspends Shenandoah Work."

[114] APC-00737640.

[115] L00000080. Lazard also "[t]entatively trimm[ed] [its Anadarko] base case [price] target to $64/share." L00000081.

In this case, Defendants' own expert Ferrell analyzed the decline in Shenandoah partner Cobalt's stock price and found that it was statistically significant at the 5% level.[116] In my opinion, the Shenandoah corrective disclosure, and related negative analyst commentary, was the only new and material information regarding Cobalt that could explain this statistically significant price decline.

66. Furthermore, in the Steinholt Report, I analyzed Anadarko's stock price decline net of potentially confounding factors (*i.e.*, factors unrelated to Shenandoah) on May 3, 2017, and, based on a conservative event study, I estimated that the Company's stock price decline was negative 3.42%, or negative $1.92 per share as a result of the Shenandoah disclosure, translating into a reduction of Anadarko's market capitalization of $1,075 million.[117]

Executed this 25th day of January, 2023, in San Diego, California.

BJORN I. STEINHOLT, CFA

[116] Ferrell Class Cert. Report, Table 3.

[117] Steinholt Report, ¶45.

Exhibit 24

– CONFIDENTIAL –

UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF TEXAS

HOUSTON DIVISION

In re ANADARKO PETROLEUM CORPORATION SECURITIES LITIGATION	§	Civil Action No. 4:20-cv-00576
	§	
	§	CLASS ACTION
	§	
	§	The Honorable Charles R. Eskridge III

EXPERT REBUTTAL REPORT OF NOAM P. BERK
JANUARY 25, 2023

Exhibit
543

I. INTRODUCTION

1. I am a Managing Director at Dean Street Capital Advisors, a financial consulting firm that specializes in advising energy asset owners and investors in complex risk management and financing solutions. I am also the co-founder and Managing Director of IOG Capital, a private equity firm that invests in upstream oil and gas assets in the United States.

2. I have over 25 years of experience in the valuation, financing, and risk management of energy companies and projects, and since 2014, I have co-managed a private equity firm that has invested in over $2 billion of oil and gas development assets.

3. I have been involved in the financing, structuring, or direct investment of over $25 billion of commodity assets, primarily in oil and gas production, but also in oil and gas infrastructure, energy generation, agriculture, and forestry. I had a leading role in the financing of several multi-billion-dollar deep-water oil and gas projects.

4. I hold an MBA degree in Finance from Columbia University, a master's degree in History from the University of North Caroline at Chapel Hill, and a bachelor's degree in History and Political Science from Rutgers University.

5. My qualifications are further summarized in Appendix A.

6. I am being compensated for my work on this report at an hourly rate of $500. My compensation is not contingent upon my opinions and conclusions, or the outcome of this matter. No conflicts of interest were created in accepting this engagement.

7. The materials on which I have relied are listed in Appendix B. This report is based on information I have reviewed to date. I understand that expert discovery and pre-trial

proceedings are still ongoing and that additional information may become available. As a result, I reserve the right to amend, refine, or modify my opinion and report, including in the event that any additional information or analysis becomes available to me.

II. ASSIGNMENT AND SUMMARY OF OPINIONS

8. I have been asked by Robins Geller Rudman & Dowd LLP ("Robbins Geller"), Class Counsel in this litigation, to consider an expert report submitted by Defendants' proffered expert Peter Keller, dated November 9, 2022 ("Keller Report").

9. It is my understanding that this is a securities fraud class action alleging defendants Anadarko Petroleum Corporation ("Anadarko" or the "Company"), R.A.Walker, Robert G. Gwin, Robert P. Daniels, and Ernest Leyendecker, III ("Defendants") misled the investing public about the commercial viability and producible resource size of Anadarko's deepwater Gulf of Mexico Shenandoah oil prospect.

10. Robbins Geller provided me with online access to the database of documents produced in the litigation, expert reports, and transcripts of depositions. I operated with the understanding that the documents produced by Anadarko are subject to a stipulated Protective Order. Appendix B is a list of documents I relied on for purposes of this report. I reserve the right to prepare illustrative exhibits based on the contents of this report if I am called to testify at trial.

11. This report is based on the materials I have reviewed to date. I understand that Class Counsel is in the process of conducting expert discovery and that additional information may become available. As a result, I may modify my conclusions based on such additional evidence. With the above qualifications in mind, based on my review and analysis

of the information currently available to me, as well as my professional experience, I have formed the following opinions in this matter:

(a) Investors evaluate large oil and gas development projects based on their potential recoverable reserves (revenue-generation potential), capital cost to develop and cost to operate, and the associated risks therein. In long lead time development projects like Shenandoah, medium- to long-term commodity prices are most relevant to evaluating the revenue generation potential of such project.

(b) The Keller Report does not explain the adverse reaction of Anadarko's shares following the alleged corrective disclosure Anadarko issued after market close on May 2, 2017. Instead, on the basis of cherry-picked quotes, Keller reaches a sweeping and unwarranted conclusion that "[m]arket participants' reactions to Anadarko's decision to suspend Shenandoah reflect that investors understood before the write-off that Anadarko was unlikely to sanction Shen-6."[1] While I am not opining on loss causation (*see* Bjorn Steinholt's November 9, 2022 expert report), Mr. Keller's failure to acknowledge the stock drop at all renders his analysis unreliable in my expert opinion.

(c) There was no significant change in medium and long-term oil prices during the period February 20, 2015 through May 2, 2017, inclusive (the "Class Period"), and they were generally higher around the time of the corrective disclosure than a year prior. Thus, commodity prices could not have been a significant factor in the write-off of all capitalized costs associated with Shenandoah, or the eventual abandonment of the project for no compensation in March 2018. Instead, Anadarko's write-off of Shenandoah after close of market on May 2, 2017 could only have been a result of other factors.

(d) Leading up to and during the Class Period, Anadarko held out Shenandoah as a "giant," which in the industry means greater than 500 million recoverable barrels of oil or oil equivalent ("500+ MMBoe EUR"), and market participants estimated the Shenandoah resource accordingly. During the Class Period, Anadarko also indicated that it would convert probable Shenandoah reserves to proven reserves.

(e) During the Class Period, Anadarko did not disclose the significant reduction of Shenandoah's potential recoverable resources or the

[1] Keller Report, ¶323.

existence of a whistleblower complaint that had been filed by a former Anadarko employee who was the senior reservoir engineer in the pre-development group tasked with evaluating the viability of the Shenandoah project.

(f) During the Class Period, the market was not aware of the extent of the faulting (lateral and vertical) in Shenandoah, nor were the significant challenges of producing oil and gas from this reservoir such as asphaltene drop-out, tarring, and costly water injection disclosed.

(g) Anadarko indicated that Shen-3 was a successful well and never retracted that characterization.

(h) Shen-4 side-track net pay was announced without any reference to encountering salt in the initial well or that internal estimates of recoverable resources were lowered by one-third as a result;

(i) Shen-5 net pay was announced without any reference to tarring encountered or that, notwithstanding that it reportedly had the highest net pay of any appraisal well, internal recoverable resource estimates were further reduced based on its results; and

(j) There is no evidence that Shen-6 was "perceived" by the market as putting at risk the entire Anadarko investment in Shenandoah, or that the market "understood" that Anadarko had already decided to write-down Shenandoah in December of 2016.

12. Based on the above, it is my expert opinion that the Keller Report does not show the market knew the truth about Shenandoah, nor does it undercut allegations in this case that Anadarko misled investors regarding the commercial viability and producible resource size of Shenandoah during the Class Period.

13. In forming my conclusions, I reviewed case materials, deployed widely accepted methodologies for evaluating large oil and gas development projects, and relied on my 25 years of professional experience as a project finance banker, commodity derivatives structurer, and private equity investor involved in over $25 billion of commodity development projects. Among other literature supporting my methodology, "Discount Rates

and Price Forecasts for Upstream Petroleum Valuations," by Babak Jafarizadeh,[2] addresses the importance of using available commodity forward curve prices to evaluate and value long-term oil and gas projects, and "Risk measurement of international oil and gas projects based on the Value at Risk method," by Cheng, *et al.*, notes that resource and economic risks are among the primary risks faced by oil and gas projects.[3] I also have a master's and a bachelor's degree in history, and employ accepted methodologies in historical research and analysis obtained in the course of both my undergraduate and master's degrees and training in historical research.

III. KEY CRITERIA FOR EVALUATING OIL AND GAS DEVELOPMENT PROJECTS

14. Before proceeding with an analysis of Mr. Keller's report, it is helpful to understand the key criteria that companies, investors, and financing parties consider when evaluating whether to proceed with, finance, or invest in large commodity development projects such as Shenandoah, as this will be relevant to my analysis of the Keller Report.

15. The following discussion is based on widely accepted industry methodologies for evaluation of oil and gas projects as well as my 25 years of professional experience as a project finance banker, commodity derivatives structurer, and private equity investor involved in over $25 billion of commodity development projects.

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[2] Babak Jafarizadeh, *Discount Rates and Price Forecasts for Upstream Petroleum Valuations*, Heriot-Watt University, Edinburgh, UK (2019).

[3] Cheng, *et al.*, *Risk measurement of international oil and gas projects based on the Value at Risk method*, 16 Pet. Sci., 199 (2018).

16. The most important consideration always for any development project is the projection of future revenues as these form the basis for evaluating whether the project is commercially viable. In the case of large oil and gas production projects in the U.S., the production volume and price of the produced commodity are the most important components of the revenue projection.

17. The volume of the projected future production is a function of the resource estimate, the projected number of wells, and projected productivity per well. In the case of Shenandoah, this was the most highly variable factor and unfortunately the variability moved in a single direction, downward, during the Class Period. In fact, it is my understanding that the estimated recoverable resource shrank over half during the course of the Class Period.

18. West Texas Intermediate oil prices ("WTI") are the appropriate benchmark as oil sold in the Gulf of Mexico trades based on the price of WTI, with adjustments for the relative quality of such oil. The most commonly quoted price for WTI is the front month expiring traded NYMEX futures contract (now traded on the CME) which is known as the "spot price" (*i.e.*, the price one would get for selling a current month's production). However, for a large development project like Shenandoah, medium-to-long-term oil prices are a more relevant benchmark for projecting future revenues (and thus project evaluation) since the project will be selling its production in the future, and not currently. Moreover, if Shenandoah had been sanctioned by Anadarko, at that time Anadarko could have locked in all or a portion of its projected Shenandoah production at a price that is based on the WTI forward curve by entering into financial or physical forward sale trades with commodity market participants such as banks, trading companies, and major oil companies.

19. After projected revenues, the most important factor in assessing the viability of a large commodity development project is the cost to build the project as well as the time required to develop it. Since these projects require significant capital investments, frequently billions of dollars, and years to develop after being sanctioned (frequently three or more years), the returns on the project are highly sensitive to both the cost to build and timing to first revenues.

20. Operating costs can also significantly impact project commercial viability. As discussed in the November 29, 2022 Corrected Expert Witness Report of Lyndon Pittinger ("Pittinger Report"), it is my understanding that Anadarko significantly underplayed the impact of adverse operating costs developments during the Class Period.

21. A number of other factors also can be important, such as regulatory requirements and risks, environmental assessments, legal issues/requirements, technology risk, political risk, etc., but these are generally secondary concerns relative to the ultimate potential revenues, estimated capital costs and project timing, and operating costs.

IV. THE KELLER REPORT IS STRUCTURALLY FLAWED AND UNRELIABLE

22. In its "Assignment and Summary of Conclusions," the Keller Report purports "to analyze information known to the market about Shenandoah before, during and after the Class Period," as well as how [undefined] "sophisticated and professional investors in the oil and gas industry (referred to herein simply as 'investors') understood the statements Plaintiffs allege are misleading" all in support of "Defendants' truth-on-the-market

defense."[4] Keller's Report is flawed and largely irrelevant to the allegations in this case that the write-off of $902 million of previously capitalized costs associated with Shenandoah after close of market on May 2, 2017, had a materially negative impact on investors following the corrective disclosure (as expert Bjorn Steinholt opines in this litigation); to the extent it may be relevant, Mr. Keller is incorrect as I will explain below.

23. The Keller Report does not attempt to explain, let alone acknowledge, the adverse market reaction to the corrective disclosure after market close on May 2, 2017. It is as if the adverse price reaction in Anadarko shares was some exogenous event independent of the corrective disclosure. Mr. Keller does not provide a plausible explanation as to why the adverse reaction described in Mr. Steinholt's expert reports occurred. Instead, Keller uncritically accepts Anadarko's claim that the Shenandoah write-off was "due to lower forecasted commodity prices."[5] However, in Section VI below, I show that the relevant prevailing commodity prices at the time of the corrective disclosure were higher than those one year prior, and that there was not significant volatility in these prices throughout the Class Period.

24. Mr. Keller also fails to address allegations of internal knowledge at Anadarko, as early as the disclosure of the Shen-3 results at the outset of the Class Period, about the lower estimated resource potential and high operating costs of Shenandoah and the negative impact on its commercial viability. As alleged in the Amended Complaint for Violations of

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4 Keller Report, §1.3, ¶15.

5 *Id.*, ¶39.

the Federal Securities Laws ("Amended Complaint"), Anadarko went to extraordinary lengths to prevent the public disclosure of the existence of the Lea Frye whistleblower complaint of spring 2016, as well as a years-long campaign to suppress its publication. Consequently, any conclusion Mr. Keller reaches regarding Anadarko's "truth on the market" defense is incomplete at best, as the whole "truth" is not analyzed in his report.

25. Finally, Mr. Keller commits the cardinal sins of historical research and analysis by including only statements and opinions supportive of his position while discarding or overlooking those to the contrary. Therefore, the conclusions and generalizations drawn by Mr. Keller from these cherry-picked "facts" are unreliable and should be discounted. These include, but are not limited to, investor knowledge of:

(a) the severity of Shenandoah's horizontal and vertical faulting and their deleterious effect on Shenandoah's economics;

(b) Anadarko's Shen-3, Shen-4 and Shen-5 disclosures, and that Shen-6 results could result in a write-off of the entire asset;

(c) the poor oil quality of the Shenandoah reservoir relative to what Anadarko initially indicated (and never corrected);

(d) the capital costs environment; and

(e) the negative economic impact of asphaltene drop-out, tarring, and insufficient aquifer water-drive.

26. All of the above would have been important to an investor analysis of Shenandoah, and only with their disclosure could the market "understand" Shenandoah's commercial viability and producible resource size during the Class Period.

V. COMMODITY PRICES DO NOT EXPLAIN THE SHENANDOAH WRITE-OFF

27. Section 3 of the Keller Report includes Figure 1, a graph that "shows the movement of Anadarko's stock price and WTI spot price . . . with the key events related to Shenandoah from 2009 to the end of the Class Period"[6] While spot oil prices and oil company stock prices may be correlated, as noted above, spot oil prices have little relevance to a development project like Shenandoah. As a result, Mr. Keller's Figure 1 is largely irrelevant in explaining developments with Shenandoah prior to and during the Class Period, and offers no support to the contention (by Anadarko and Mr. Keller) that commodity prices were a significant factor in Anadarko's write-off of Shenandoah.

28. The figure below (Figure A) charts the development of the average three-to-six year (medium-term) forward NYMEX WTI prices, and spot NYMEX WTI prices during the Class Period.[7] As is evident from the chart, there was little net change in medium-term forward WTI prices during the last year of the Class Period (*i.e.*, the period most relevant to assessing whether commodity prices had a significant role in the write-off of Shenandoah). In March of 2016, medium-term WTI prices were $47.62/bbl and they were $54.52/bbl in March of 2017. Furthermore, the long-term price, as evidenced by the average 2024 NYMEX price for WTI, was also higher in late April of 2017 (~$57/bbl) than it was in the early May of 2016 (~$55/bbl). Based on the higher prevailing oil prices in Q1/Q2 2017 relative to Q1/Q2 2016, and the narrow range in which medium-term WTI prices traded over

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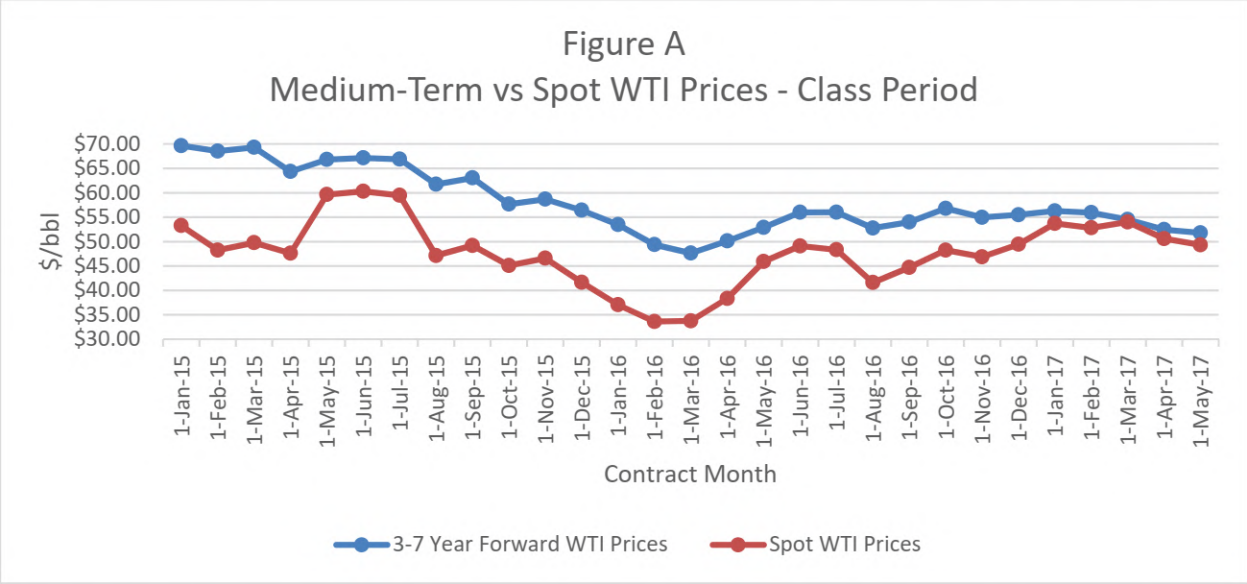
6 Keller Report, ¶29.

7 CME Group Historical Data, WTI NYMEX Futures.

the entire Class Period, and, there is no basis for concluding that commodity prices played a significant role in determining the timing of Anadarko's write-off of Shenandoah.



29. Consequently, Anadarko's corrective disclosure was inaccurate as there were no meaningful changes to forecasted commodity prices throughout the entire Class Period. If commodity prices were the primary driver of the Shenandoah write-down, it is unclear why Anadarko did not announce a write-down of its higher-cost proved reserves and/or other development projects at this time as well:

> Impairments during the three months ended March 31, 2017, were primarily related to oil and gas properties in the Gulf of Mexico due to lower forecasted commodity prices and a U.S. onshore midstream property due to a reduced throughput fee as a result of a producer's bankruptcy.[8]

30. The write-off of Shenandoah could only have been a result of other factors.

[8] Anadarko Form 10-K at 2, filed with the SEC on May 2, 2017.

VI. INVESTOR UNDERSTANDING OF SHENANDOAH'S ESTIMATED POTENTIAL RESOURCE AND ITS CONVERSION TO PROVEN RESERVES

31. Mr. Keller incorrectly suggests that Anadarko did not provide the market with an indication of Shenandoah's estimated resource size and expected value in Sections 5.1 and 5.2 of his report. Leading up to and during the Class Period, Anadarko touted Shenandoah as a "giant" (*i.e.*, 500 MMBoe of estimated recoverable resources or more).[9] In addition, analysts and Class Representative Norfolk County Council as Administering Authority of the Norfolk Pension Fund's ("Norfolk") investment manager Sarasin & Partners LLP ("Sarasin") documented the market understanding that Anadarko held out Shenandoah as a "giant" in reports and investor call notes; notably, such reports and investor call notes are omitted from the Keller Report.[10]

32. Furthermore, the "$2-$4 billion net opportunity" Anadarko slide from the March 4, 2014 conference indicated that Shenandoah had significant potential resource size and value. While Mr. Keller contends the slide refers to the entire basin, it is also clear that at that time Shenandoah was viewed by far as the largest of the basin prospects in the Anadarko portfolio due 1,000' of announced net pay in Shen-2, whereas the Coronado and Yucatan announced results at that time were 400' and 250' of net pay, respectively.[11] Anadarko never

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[9] March 19, 2013 Anadarko press release, "Anadarko Announces Shenandoah Appraisal Well Encounters More Than 1,000 Net Feet of Oil Pay"; JanHen_00014482 at 83 (Anadarko Third-Quarter 2015 Operations Report referring to Shenandoah as a "giant oil discovery").

[10] SARASIN0002082 (Sarasin notes from an Anadarko investor call in 2013, which indicated Shenandoah was a "giant (500+mm barrels)").

[11] APC-00578013 (May 6, 2013 Anadarko Q1 2013 press release).

disclosed to the market that the net opportunity of Shenandoah decreased during the Class Period. Consequently, based on these disclosures, it would be surprising if analysts and investors did not ascribe significant potential resource to Shenandoah during the pre-Class and Class Periods, as multi-billion dollar net project values (30% Anadarko working interest at this time) can only be realized from giant discoveries.

33. Interestingly, the Keller Report attempts to argue that "[i]t was common for analysts to take the limited information provided by Anadarko and the Shenandoah Partners and create their own models and assumptions. These were inherently speculative and vary across analysts, as was the case here."[12] The report then proceeds to quote a range of analyst resource estimates from reports dated March 20, 2014, all averaging 500 MMBoe or more, fully consistent with the Anadarko messaging that Shenandoah was a giant field. Moreover, the Keller Report's discussion of the March 20, 2014 analyst reports takes place prior to its discussion of the March 4, 2014 $2-$4 billion net opportunity slide, which misleadingly creates the impression that these analyst reports were not incorporating the information presented by Anadarko in the $2-$4 billion net opportunity slide.

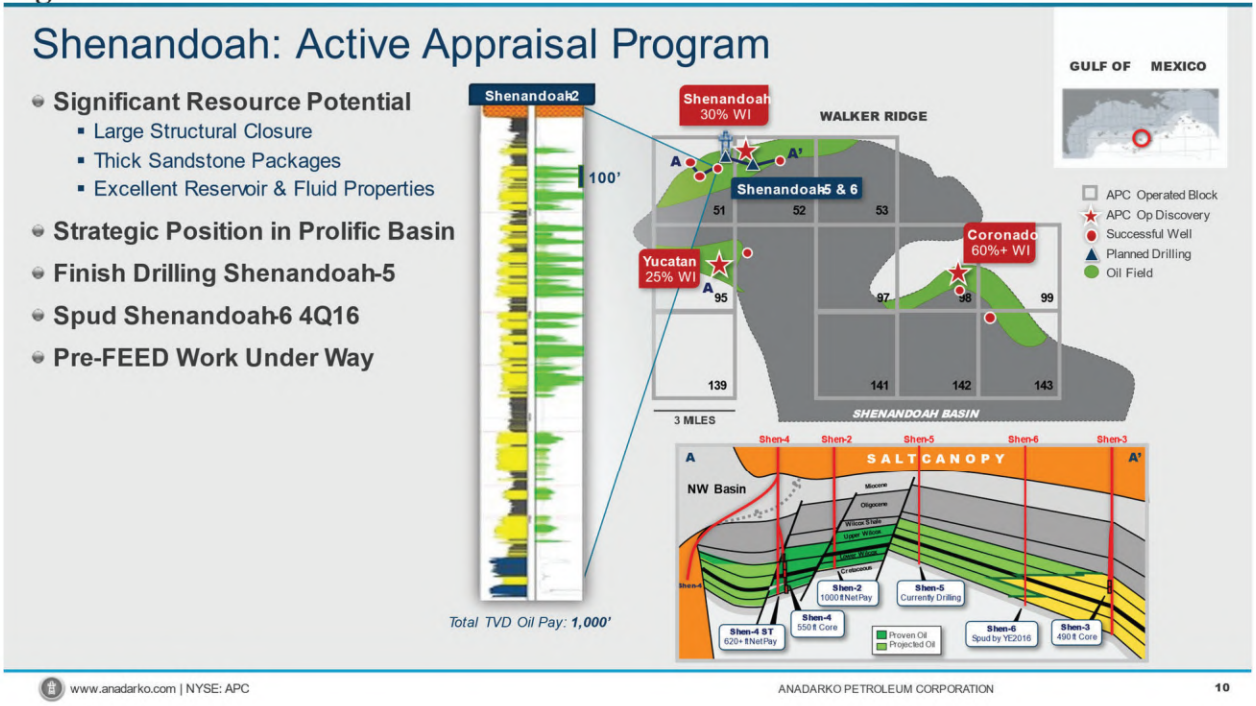
34. Moreover, at the May 24, 2016 UBS Global Oil and Gas Conference while discussing Shenandoah and referencing Figure B below, Shandell Szabo, Anadarko's Director of Investor Relations, stated:

> "[A]s Bob mentioned, we just finished – we're just about to finish up the five wells, so we can't reveal exactly what's going on there, but what I would say is that it looks a whole heck of a lot like the log that you're looking at right here [Shen-2 log]. And when you look at where that falls on that cross section,

[12] Keller Report, ¶135.

you can see the Number 5 well up there on that cross-section. So you can see that lighter green color – we're going to be able to turn that dark green. ***So the lighter green on there is the probable and the darker green is the proven. And so we're going to have the ability for that large area over there to go ahead and say, yes, that's proven. So that's tremendous for us***.[13]

Figure B



35. I note the lack of any conditionality in Ms. Szabo's statement regarding proven reserves. Consequently, not only did Anadarko tell the market that Shenandoah was a giant field during the Class Period, Anadarko even told investors that Shenandoah would have "proven reserves" over a "large area."[14] This undercuts Mr. Keller's various contentions that

[13] APC-01753704 at 11-12 (May 24, 2016 UBS Global Oil & Gas Conference transcript) (emphasis added).

[14] *Id.* at APC-01753712.

investors necessarily "understood" Shenandoah as "high risk" or heavily discounted its potential.[15]

36. Based on Anadarko's pre-Class and Class Period statements, in my expert opinion, Anadarko made clear to investors and analysts that the Shenandoah opportunity was "giant" field or greater than 500 MMBoe EUR and that Anadarko expected to book proved reserves in Shenandoah.

VII. MARKET KNOWLEDGE OF ANADARKO'S DECREASING INTERNAL RESOURCE ESTIMATES AND THE FRYE WHISTLEBLOWER COMPLAINT

37. The Keller Report has no discussion of Anadarko's internal assessments that showed significant declines in Shenandoah's estimated resource potential after every well after Shen-2. I refer readers to the Pittinger Report for detailed explanations of the factors that drove these resource potential reductions, some of which I will discuss below in Section IX. Pittinger notes that Shen-3 resulted in a 47% decline in estimated resource potential while Shen-4 resulted in a further one-third decline, for a total decline of 64% in resource potential based on the results of these two appraisal wells alone. Furthermore, even Shen-5, with announced net pay in excess of 1,000' resulted in a 17% decrease in Anadarko's Shenandoah's resource potential. Yet, throughout the Class Period, Anadarko continued to indicate that the Shen-3 through Shen-5 appraisal wells were "successful" and that Shenandoah was within the same expectations that the Company previously publicly stated.

[15] Keller Report, ¶¶16, 91.

38. Towards the end of the Class Period, the internal Anadarko net estimate of recoverable resources after Shen-5 of 353 MMBoe was remarkably similar to the 387 MMBoe 2C resource estimate (equivalent to a resource estimate) for the Shenandoah project claimed by its largest working interest owner as of August of 2021.[16]

39. The Keller Report mentions Lea Frye, the former lead Shenandoah reservoir engineer for the pre-development team and later a whistleblower, two times, in both instances quoting from the Amended Complaint. There is no discussion whatsoever of the whistleblower complaint itself, Anadarko's active suppression of its existence and contents, or whether knowledge of such a complaint and its contents would have been important to investors – which in my expert opinion it would have been. Furthermore, there is no discussion in the Keller Report about why Anadarko was opposed to the disclosure of the existence of this complaint. If in fact Anadarko was comfortable its disclosures regarding Shenandoah were fulsome and appropriate, there would presumably have been little to fear from disclosing the existence of the whistleblower complaint.

40. Consequently, Mr. Keller's views on what the market knew during the pre-Class and Class Periods are undercut by his failure to address the significant and undisclosed negative impacts of the Shen-3 through Shen-5 wells on Anadarko's resource estimates for Shenandoah and the whistleblower complaint, among other undisclosed risks.

[16] APC-01752403 at 06 (Navitas Petroleum presentation, "Shenandoah – Financial Close," dated August 2021).

VIII. KELLER REPORT'S SELECTIVE EVIDENCE AND FAILURE TO INCORPORATE CONTRARY VIEWS

41. The Keller Report spills much ink attempting to divine investor and analyst understanding of events prior to and during the Class Period. However, the conclusions it reaches regarding investor or market understanding of Shenandoah based on Anadarko disclosures are at best incomplete and frequently unsubstantiated or misleading.

42. I will point out examples, by section (of the Keller Report), that demonstrate the frequency of these issues.

A. The Keller Report Provides Selective, Misleading, and Unsubstantiated Analysis About What Investors Understand Generally About the Offshore Oil and Gas Business

43. Section 4 of the Keller Report purports to "assess what investors understand about the offshore oil and gas business,"[17] presumably during the Class Period and prior. I highlight some of the more problematic portions of this section below:

44. Paragraph 51 begins with, "[i]t is common for operators not to release resource ranges for a specific prospect during the appraisal process," however, the Anadarko quote immediately following this statement is in regard to their approach to disclosure when a ***discovery*** is made, so no conclusion regarding Anadarko or any operator releasing resource ranges "during the appraisal process" can be drawn from Anadarko's statement herein.

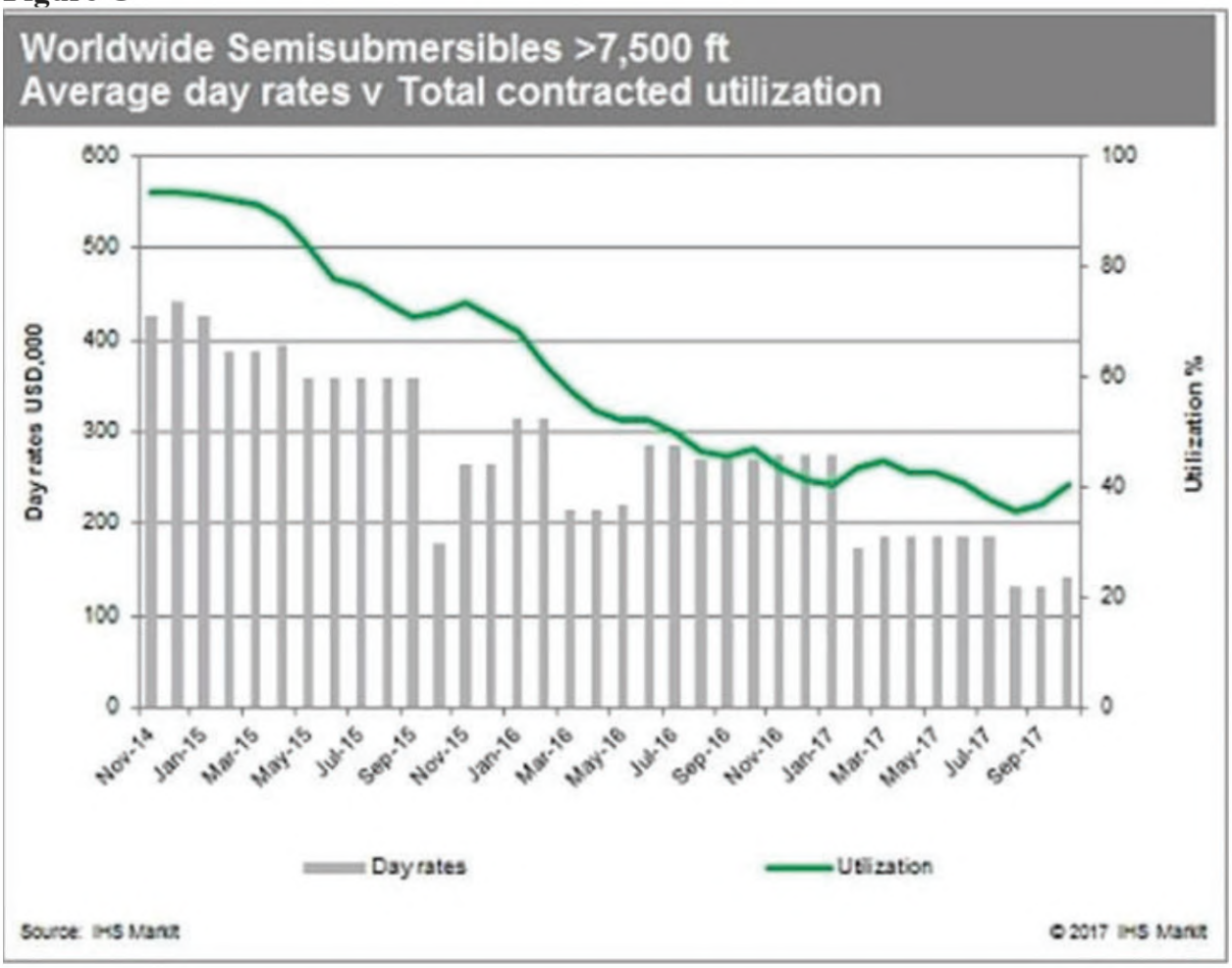
45. Paragraph 52 does discuss the appraisal process and quotes a March 2012 Anadarko investor conference transcript discussion in which Anadarko indicated that they do release the results of appraisal wells and that they provide their "net pay numbers" in which

[17] Keller Report, ¶46.

they supposedly "'throw out things that don't really meet the deepwater rock qualification,'" and that they also "'***talk about a recoverable resource within our expectations of what our recovery factors are***.'" (Emphasis added.) This latter quote completely contradicts the point made in Paragraph 51. Regrettably for Anadarko's investors, it seems by the time of the Class Period, Anadarko abandoned the sensible approach to appraisal result disclosure they set forth in 2012.

46. Paragraphs 57 and 58 discuss day rates for drillships, and note costs prior to the Class Period were highest in 2013 (which was largely due to high oil prices at that time), and lowest in 2020 due to COVID, and then includes a graph of day rates for "Ultra Deepwater Drillships" from 2018 to 2021, a period entirely irrelevant to the Class Period. Moreover, as seen in Figure C below, day rates for Ultra Deepwater Drillships during the Class Period generally trended down, so that implies that the overall project costs were coming down as well.

Figure C



47. Anadarko also represented to the market that costs were coming down significantly. On May 24, 2016, during a discussion of Shenandoah at the UBS Global Oil and Gas Conference, Shandell Szabo commented that "the other thing that I would note is that we've actually dropped our cost out here by 40% from the beginning to the end."[18] At the same conference, Ms. Szabo and CFO, defendant Gwin also assured investors that there

[18] APC-01753704 at 12 (May 24, 2016 UBS Oil & Gas Conference transcript).

were "tieback opportunities in the [GOM] area" under consideration in developing Shenandoah.[19]

48. Consequently, there is no reason to believe that rising rig costs or other development costs had any impact on Anadarko's decision to write-off Shenandoah.

49. Paragraph 69 of the Keller Report quotes a McKinsey report from July of 2018 that states, "although exploration of Lower Tertiary (*i.e.*, Paleogene) [in the Gulf of Mexico] led to large size discoveries, most of the discoveries were not developed as of mid-2018 as a result of the complexity of the reservoir and the uncertainty of the economics."[20] This conclusion, which notably was ***after*** the Class Period, is fully consistent with Plaintiffs' contention that ***during*** the Class Period Anadarko downplayed the severity of faulting and significant costs associated with potential development of Shenandoah, among other adverse information known by the Company about Shenandoah at the time. Anadarko repeatedly told the market that Shenandoah's reservoir quality was "excellent" and thus significantly better than most Lower Tertiary discoveries,[21] which were not accurate characterizations based on what Anadarko knew at the time.

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[19] *Id.* at APC-01753715.

[20] Keller Report, ¶69.

[21] Keller Report, ¶193 (defendant Daniels' response to question regarding Shen-3: "'[r]eservoir quality was good'"); *id.*, ¶246 (defendant Daniels' discussion of Shen 4: "'[t]hat's a good reservoir quality'"); November 9, 2022 Expert Report of Robert Merrill, Ph.D. ("Merrill Report"), ¶96 (Ms. Shandell Szabo, Anadarko's representative at the UBS Global Oil & Gas Conference, "described Shen as having 'Miocene-like properties, which means that the reservoir quality is very good. You're looking at porosities of up to 25% here. You're looking at permeabilities in the 100 millidarcy range. Some of the individual sands see 300, 400 millidarcies perm. And then the last thing you look at is the fluid property, since

50. In Paragraph 77, the Keller Report makes the contention that "[m]any exploratory wells that discover hydrocarbons, even those followed by multiple appraisal wells that similarly discover hydrocarbons, do not justify the significant subsequent commitments needed to monetize resources" without providing any statistics or examples to support this conclusion. As I note in Paragraph 78 below, several market analysts expressed surprise or disappointment that Anadarko would write-off a project after drilling so many wells.

51. Paragraph 78 of the Keller Report addresses the cost and timing elements of developing a project such as Shenandoah: "Oil and gas exploration companies and their investors do not focus narrowly on the size of the potential resources without also considering the cost of the development. Significant resources combined with high development costs and an extended timeframe to extraction could still result in a rational decision not to proceed – or at least postpone – development." In the case of Shenandoah, as noted above, development costs were decreasing over the Class Period and Anadarko never raised the "timeframe" of the development as an issue adversely impacting the economics of Shenandoah.

52. Paragraphs 81 and 82 of the Keller Report highlight the challenges faced by oil and gas companies throughout the Class Period as oil prices, including long-term prices, were significantly lower than they had been in the years ***immediately preceding*** the Class

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it's very light oil out here. So from the overall discovery, it's got everything that you're looking for.' But the data showed the average porosity for Shen-2, Shen-3, and Shen-4 ST-1 was 20%. Further, as discussed above, Shen posed serious challenges as to tar and AOP.").

Period. Oil prices were higher prior to the Class Period than during the Class Period, but during the Class Period the relevant oil price was remarkably stable and higher at the time of the write-off than it was the year before.[22] So, it is not plausible to say that suddenly, after years of appraisal, it was oil prices that caused Anadarko to abandon the Shenandoah project since medium- and long-term prices simply had not changed materially throughout the Class Period. Moreover, if oil prices were the only factor, Anadarko presumably would have kept appraising the discovery (*i.e.*, drilled Shen-7 as Ms. Szabo alluded to at an investor conference[23]) to hold the leases and preserve its option to develop the field at a later date when prices were higher. Anadarko chose not to, however, confirming that there were factors other than commodity prices that led to the write-off after the close of market on May 2, 2017 (and then the eventual abandonment, for no compensation, in Q1 2018).

53. In Paragraph 91, Mr. Keller asserts that, "Shenandoah was a potentially important asset but not a key driver in Anadarko equity valuation." It is unclear what the basis is for Mr. Keller's assertion or what a "key driver" means, and I am also unaware of any assertion made by any party to this matter that Shenandoah was the only reason any investor invested in Anadarko. On the other hand, Shenandoah was one of Anadarko's purportedly key oil and gas assets throughout the Class Period, as the Company repeatedly touted to the market. Moreover, the October 1, 2021 Expert Report of Bjorn I. Steinholt, CFA and the February 2, 2022 Expert Rebuttal Report of Bjorn I. Steinholt, CFA present an

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[22] Medium-term oil WTI prices averaged over $83/bbl in 2013 and nearly $82/bbl in 2014, CME Group historical data, WTI Futures.

[23] *See* Deposition Ex. 470 at 10.

event study showing that the write-off of Shenandoah caused a statistically significant decline in Anadarko's share price.

54. Paragraphs 94-97 of the Keller Report highlight that the value ascribed to Shenandoah by 14 of 22 analysts was not explicit (so is unquantifiable) and that the eight market analysts who did ascribe a value had a wide range of opinions, which is to be expected in a widely traded stock like Anadarko's was at the time. I note that the Keller Report did not include the April 12, 2017, $2.28 billion value ($4.11/share) ascribed to Shenandoah by Class Representative Norfolk's investment manager Sarasin as late as April 2017,[24] or the May 3, 2017 Drexel Hamilton analyst report which indicated it had ascribed $6.25 per share to Shenandoah in its Anadarko NAV just prior to the write-off.[25]

55. Paragraphs 100-105 of the Keller Report discuss Anadarko's public statements about the portfolio management of its exploration and appraisal assets. This section actually serves to highlight how unexpected and abnormal the write-off of Shenandoah was relative to the usual develop or sell strategy pursued by Anadarko. Simply put, Anadarko neither developed nor sold Shenandoah (or monetized Shenandoah in any way); instead, it wrote Shenandoah off and then later abandoned it at a cost of over $900 million.

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[24] SARASIN0000051 at 58 (Sarasin report, dated April 12, 2017, in "Building NAV" section).

[25] APC-01379611 at 12 (May 3, 2017 Drexel Hamilton Anadarko analyst report).

B. The Keller Report Provides Selective, Misleading or Unsubstantiated Analysis About How Investors Understood the Shenandoah Project

56. Section 5 of the Keller Report purports to "analyze how investors understood the Shenandoah project given the totality of information in the market,"[26] and Mr. Keller concludes, at its outset, "that Plaintiffs' allegations either reflect a misunderstanding of how investors understood these statements or ignore other information in the market. By the time of the alleged corrective disclosure, investors were aware of the difficulties that made sanctioning Shenandoah less attractive. ***The write-off thus did not result from risks and difficulties known to Anadarko that they had failed to disclose***."[27]

57. As I have discussed above and is set forth in the Pittinger Report and the Merrill Report, there was significant information about Shenandoah that was not disclosed to the market during the Class Period. Moreover, the Keller Report does not even attempt to explain why the write-off occurred after market close on May 2, 2017, as opposed to any other time during or prior to the Class Period. There is no discussion of why the results of Shen-6 condemned the project, or why Anadarko was putting forth the idea it might drill a Shen-7 in 2016, even if Shen-6 failed to find the OWC.[28] Shen-3 too failed to encounter hydrocarbons, and Shen-4 was known internally to have been extremely disappointing, yet

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[26] Keller Report, ¶106.

[27] *Id.*, ¶107 (emphasis added).

[28] Deposition Ex. 470 at 10 ("So, yes, I would say that that wel [Shen-6] – there's the opportunity for one more well bore if we don't find the oil-water contact, because then we would be forced to drill one more well. But if we do find the oil-water contact, we're going to have a really good feeling for that eastern side of the basin.").

Anadarko proceeded to continue its appraisal after both of these wells had shown poor results. The only explanation put forth in the Keller Report is to uncritically accept Anadarko's public claim that commodity prices explain the Shenandoah write-down. But as I have discussed several times above, there was no decrease in medium- or long-term oil prices around the time of the corrective disclosure.

58. Paragraph 154 of the Keller Report lays out 12 allegations in the Amended Complaint of material omissions by Anadarko:

(a) credible test results and analysis indicated Shenandoah was much smaller and less commercially viable than Defendants had previously and continued to indicate;

(b) the Senior Reservoir Engineer for the Shenandoah resource had determined the reliability of test results and analysis that indicated the Shenandoah resource was much smaller and less commercially viable than Defendants had publicly indicated;

(c) the fluid quality from the Shenandoah appraisal wells was poor;

(d) Anadarko's RCT had determined the reliability of test results and analysis that indicated Shenandoah was much smaller and less commercially viable than publicly indicated;

(e) Anadarko incentivized exaggerated resource assessments by offering bonuses to its exploration team based on preliminary assessments without validation by the development team or the RCT and without a claw-back for assessments later shown to be exaggerated;

(f) Defendants had actively suppressed the truth about Shenandoah through a campaign of retaliation against and harassment of the Senior Reservoir Engineer Frye to set an example for others who were considering speaking the truth about Shenandoah;

(g) Shen 3 was a dry hole;

(h) Shen 4 confirmed massive salt deposits that would obstruct or prevent access to deposits;

(i) Shen 4 indicated a much smaller size resource than Defendants had described after Shen 2;

(j) Leyendecker prohibited employees from using accurate maps that would reveal faulting and other significant shortcomings in the Shenandoah resource;

(k) Anadarko had defied its own internal policies and procedures by, among other things, disregarding the findings and recommendations of the RCT; and

(l) Anadarko's plan for extracting oil from Shenandoah was one that no one had ever successfully deployed.

59. The Keller Report fails to address the vast majority of these claims, only (g), (h), (i), and (l) are discussed in any detail.

60. Mr. Keller addresses (l) first in Paragraphs 156-170. Nowhere in the Keller Report or in any Anadarko disclosure am I aware of any mention that 20K psi technology played a part in the write-off and abandonment of Shenandoah. Mr. Keller acknowledged as much in his January 17, 2023 deposition in this matter.

61. The Keller Report devotes 27 pages (Paragraphs 171-228) to the discussion of Shen-3, arguing that the market clearly understood that this well was a "dry hole." However, at the time of the Shen-3 public disclosure, at least one market analyst believed that Shen-3 encountered hydrocarbons: "The #3 appraisal demonstrated similar well-developed reservoir sand farther down-dip and encountered 1,000 feet of net oil pay."[29] Anadarko's announcement of the Shen-3 results, which do not appear ever to have been amended, corrected, or superseded, also left the market with a distinct impression that the results of this

[29] LAZARD-ANADARKO 0030971 at 71 (February 4, 2015 RBC Capital Markets analyst report).

well were unequivocally positive, even though internal Anadarko resource estimates were lowered significantly, and the commercial viability was in doubt.

62. The notion that the Shen-3 well was useful for determining the oil/water contact of the Shenandoah field as a whole, was particularly egregious. As laid out in exhaustive detail in the Merrill and Pittinger Reports, Anadarko's contention that Shen-3 enabled the projection of OWCs for across the Shenandoah field was based on the faulty assumption of reservoir communication between Shen-2 and Shen-3, which was known to be incorrect within the Company and would have been important information for the market to consider. In addition, the quality of the Shen-3 sands, in terms of porosity and permeability, was known within the company to be inferior to that of Shen-1 and Shen-2. Yet, Anadarko's Shen-3 announcement described these sands as "the same well-developed reservoir sands" as those found in Shen-2, which is inconsistent with the inferior characteristics of the Shen-3 sands.[30]

63. The Keller Report's discussion of Shen-4 results and supposed May 2016 disclosure of faulting is also incorrect. I refer readers to Section F of the Pittinger Report for an in-depth discussion of the adverse information known throughout the Class Period about faulting and negative results from Shen-4. The Keller Report does not address the substance of the allegations in the Amended Complaint nor many of the issues raised in the Merrill and Pittinger Reports. Among other adverse information known at the Company at the time, there was no disclosure of significant and adverse oil quality differences between Shen-4 and

[30] ANADARKO_00000361 at 72 (Anadarko Fourth-Quarter 2014 Operations Report, dated February 2, 2015).

Shen-2. Moreover, even after encountering small-scale faulting between Shen-4 and its two side-track wells, *i.e.*, at a magnitude of 300'-400', as well as faulting between Shen-2 and Shen-3, which was also not disclosed, Anadarko continued to present maps of Shenandoah showing the eastern portion of the field with no faulting. Notwithstanding the 47% reduction in internal resource estimates due to Shen-4, Anadarko continued to indicate that Shenandoah was a "giant oil discovery"[31] at this time (*i.e.*, 500MMBoe or more of recoverable resource) and tell the market that Shenandoah was still on target with the expectations that the Company had put out there.[32]

64. As to Shen-4, Anadarko never used the word "salt" in its disclosures, nor did it disclose the fact that the results of Shen-4 reduced the resource size by one-third. The salt encountered in the original wellbore was viewed more as an indication of where the field's eastern extent was located. Similar to Shen-3, the Anadarko announcement of Shen-4 results was phrased in the positive and unsurprisingly thus taken as a positive by many market analysts. For example, RBC Capital Markets wrote that "[t]he fourth Shenandoah appraisal well successfully encountered more than 620 net feet of oil pay, extending the lowest know oil column downdip. This could portend increasing the resource potential in the basin."[33]

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[31] *See, e.g.*, APC-00205621 at 22 (Anadarko Third Quarter 2015 Operations Report, dated October 27, 2015).

[32] *See* APC-01448787 at 91 (speaker was Bob Daniels but incorrectly identified in the transcript as Bob Gwin).

[33] LAZARD-ANADARKO_0045267 (October 28, 2015 RBC Capital Markets analyst report).

Such views were in direct contradiction to internal Anadarko estimates which were further decreased by a third after Shen-4.

65. Further, whatever was generally "understood" about the Lower Tertiary Sands in the Gulf of Mexico, Anadarko reassured investors that Shenandoah had higher quality sands than typical Lower Tertiary and held Shenandoah out as having "excellent reservoir" qualities. Further, there is no indication in the Keller Report that Anadarko supplied the market with any appreciation of how significantly a faulting affected Shenandoah's commercial viability or that its ultimate impact would be so severe.

66. And while Mr. Keller opines that investors understood that additional wells would be drilled, there is no evidence that Anadarko disclosed that investors or analysts concluded that Shenandoah's development was at risk based on the information to be gathered from Shen-5 and Shen-6. Further, the evidentiary record shows that Anadarko made its decision to write-down Shenandoah ***before*** Shen-6 TD'd, so Mr. Keller's opinion implicitly concedes Anadarko misled the market.[34]

67. I also note that the discussion of whether Anadarko would sanction the Shenandoah project at less than $60/bbl oil prices is largely irrelevant to the matter at hand as Anadarko never publicly discussed a specific commodity price at which Anadarko would sanction Shenandoah, and in any event, a decision to delay sanction does not imply that an asset will be written off or abandoned.

[34] *See, e.g.*, APC-00307805; September 1, 2022 Deposition of Darrell Hollek at 188:24-191:7.

68. As to Shen-5, nowhere does the Keller Report show that Anadarko gave the market any inkling that the results of this well actually lowered internal Anadarko resource estimates by 17% from the post Shen-4 levels as a result of a number of negative findings from the Shen-5 well or that it hit tar.[35] The negative findings that Anadarko failed to disclose about Shen-5 included:

(a) significant vertical compartmentalization;

(b) 22' of tar in the Lower Wilcox sands; and

(c) lower quality oil (higher gravity) in the Lower Wilcox sands.

69. None of the Anadarko statements quoted in the Keller Report allude to any of these issues, and the market was led to believe that Shen-5 was unambiguously positive. A number of the analyst quotes discussing Shen-5 found in the Keller Report make this abundantly clear:

> JP Morgan: "The Shenandoah-5 appraisal well encountered 1,040 net feet of pay, which was similar to the Shenandoah-2 well. The company also raised its interest in the project to 33% by participating in a preferential-rights process. APC should spud Shenandoah-6 later in '16, with hopes of moving the project into the development queue."[36]
>
> Goldman Sachs: "Shenandoah appraisal favorable. While Shenandoah startup remains years away, a 1K'+ oil column and lack of establishing oil-water contact seen in the fifth appraisal well (testing eastern portion) are positive."[37]
>
> Macquarie Research: "Strong Shenandoah Result but Hurdles Remain: The result from the Shenandoah-5 well likely increases the resource potential of the discovery. This could benefit the ultimate economics of the project."[38]

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[35] Pittinger Report, ¶153.

[36] Keller Report, ¶289(b).

[37] *Id.*, ¶289(f).

70. Indeed, as Mr. Keller concedes, Anadarko announced that Shen-5 encountered ***more*** pay than Shen-2, so according to his own metric (net pay), the market logically would have understood the results of Shen-5 as ***increasing*** the resource size, when in fact, it ***decreased*** it by 100 MMBOE. Further, prior to and throughout the Class Period, there was a wide range of market estimates of the resources size and value to Anadarko. Consequently, it is not surprising to see some analysts were more negative and others more positive. Simply highlighting some of the more negative views taken is not dispositive with respect to overall market views. In any case, Mr. Keller concedes that many analysts attributed a portion of Anadarko's valuation to Shenandoah throughout the Class Period or in other cases to the deepwater exploration premium ascribed to Anadarko shares.

71. Mr. Keller says that after Shen-5, investors understood the decision to FID Shenandoah would be based on results of Shen-6. Again, this conclusion is not supported by any specific evidence in the Keller Report. What is clear is that Anadarko told investors that Shen-6 was being drilled to find the OWC on the eastern side of the field. There is no evidence in the Keller Report that investors and analysts viewed the potential results from the Shen-6 as likely to determine whether or not the field would be developed, much less written off in its entirety without any monetization to the Company. To the contrary, the Company told the market that after Shen-6, there may be a Shen-7, thereby leading the market to believe Shen-6 was ***not*** the end of the road.[39]

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[38] *Id.*, ¶289(h).

[39] *See, e.g.*, Deposition Ex. 470 at 10.

72. The Keller Report's discussion of Shen-6 is also replete with subjective interpretations unsupported by evidence. For example, in Paragraph 311, Mr. Keller claims that: "Market participants acknowledged the difficulties Anadarko was having at Shenandoah and the challenging commodity price environment." The support for this conclusion is three quotes from Goldman Sachs reports (the first two from February 2017, and the latter from March 24, 2017):

> Shenandoah (Gulf of Mexico) – We expect management to announce results from the Shenandoah-6 appraisal well over the next few months. We believe positive results will allow Anadarko to move ahead with the development of the discovery.
>
> Shenandoah: $50/bbl breakeven; further clarity on project economics and timing to drive greater credit. Based on our conversations with investors, they remain concerned on the potential value and timing of the Shenandoah discovery in Gulf of Mexico.
>
> APC indicated that major Gulf of Mexico greenfield projects like Shenandoah (our target assumes $1/shr) is unlikely to get final approval in a $50-$55 per bbl environment.

73. None of these quotes allude to any specific "difficulties" Anadarko was having with Shenandoah, and as discussed above, the commodity price environment was not significantly different during this period relative to others in the Class Period. Instead, analysts point to the fact that the timing of the sanction of the project was in question due to prevailing oil prices at that time. But delayed/uncertain timing of the project's sanction did not imply any risk of a complete write off and abandonment of the project.

74. In Paragraph 313, the Keller Report states that Anadarko's 2016 Form 10-K "cautioned the market" that Anadarko "might write off Shenandoah" based on its purported

new inclusion of the language below in the risk disclosure section of the report discussing drilling activities.

> As of December 31, 2016, we had $1.7 billion in suspended well and associated non-producing leasehold costs related to 11 U.S. offshore and international exploration projects, which includes approximately $800 million related to our Shenandoah project in the Gulf of Mexico. Certain of these future exploration and appraisal drilling activities may not be successful and, if unsuccessful, could result in a material adverse effect on our future results of operations and financial condition. While all drilling, whether developmental or exploratory, involves these risks, exploratory drilling involves greater risks of dry holes or failure to find commercial quantities of hydrocarbons. Because of the percentage of our capital budget devoted to higher-risk exploratory projects, it is likely that we will continue to experience significant exploration and dry hole expenses.

75. The language above does not disclose that Shenandoah was about to be written down entirely. Moreover, only the first sentence is newly added language, whereas Keller gives the misleading impression that this entire paragraph is newly included. It is easy to imagine benign reasons Anadarko disclosed the overall and Shenandoah-specific suspended well and leasehold amounts, given their significant value. As noted earlier in this report, Keller fails to address the fact that Anadarko had already decided by December of 2016 it would write down Shenandoah. Based on this, the disclosure above is not consistent with internal Anadarko views of Shenandoah the time it was issued.

76. In Paragraph 315, the Keller Report concludes that: "In February 2017, some market participants similarly noted a decline in confidence, expecting a Suspension of Production or potential operational challenges that would delay sanctioning." The support for this conclusion is based on two market analyst quotes from early February 2017 from Goldman Sachs and UBS:

> Goldman Sachs: "1H 2017: APC plans to spud the Shenandoah #6 appraisal well in late 2016 which it expects to find the oil-water contact. Management believes Shenandoah #6 appraisal well will help determine the next stage of the project. With its 3Q 2016 operations update, APC stated it has chosen a semi-submersible concept to support the potential development as part of these efforts. The FEED on a potential semisubmersible will continue, while the company continues appraisal drilling to further delineate the opportunity before making a future sanctioning decision. The primary terms on certain leases covering the Shenandoah project expired in 2014 but are being held by continuous operations on the Shenandoah project, meaning that the operators cannot discontinue operations at Shenandoah for more than 180 days or such leases will terminate. ***We expect that APC will eventually file for approval of a Suspension of Production in order to preserve its acreage***."[40]
>
> UBS: "At the Shenandoah prospect (33% w.i), APC spud the Shendandoah-6 appraisal well in December and seeks to establish oil-water contact on the eastern flank of the field which would give indication of a true resource size; this should enable it to determine resource size and progress towards a final investment decision, with first production roughly three years later. However, the challenge at Shenandoah is learning how to operate in a high pressure environment (20,000 pounds per square inch) so no timing was given on project sanction. While APC continues to evaluate the commerciality of the Shenandoah fields, it has chosen a Semisubmersible concept to support the potential development with FEED engineering ongoing."[41]

77. Neither of these quotes note any particular decline in Anadarko confidence in Shenandoah. The highlighted comment in the Goldman Sachs quote merely states a low-cost strategy that Anadarko might have been expected to pursue if drilling results at Shenandoah were positive yet commodity prices were not sufficiently high to justify immediate project sanction. Again, the quoted statements do not implicate a write-off or abandonment. A suspension of production allows a leaseholder to discontinue operations during the period of the suspension and maintain its ownership of the lease. As for the UBS quote, the analyst

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[40] APC-01333456 (February 5, 2017 Goldman Sachs analyst report) (emphasis added).

[41] APC-01333349 (February 1, 2017 UBS analyst report).

appears optimistic that Shenandoah would progress to a final investment decision and ultimately, production. The lone challenge identified is 20k psi technology – there is no mention of faulting or structural complexity, asphaltene, or that commerciality was already in question. It is unclear to this reader how the UBS quote could even be interpreted to indicate that there was a decline in Anadarko's confidence in the Shenandoah project given the dearth of challenges identified.

78. In Paragraph 317, the Keller Report claims that investors "understood before Anadarko's alleged corrective disclosure that Shen-6 was wet." However, such disclosures came from Anadarko's Shenandoah partners and Anadarko muddied the waters by announcing that it would drill a Shen-6 sidetrack "to find the oil-water contact."[42] The market only became aware that the Shen-6 sidetrack failed to find the OWC when the corrective disclosure was issued. Consequently, the Keller Report conclusion regarding Shen-6 is misleading and incomplete.

79. Finally, the Keller Report's conclusion in Paragraph 323 that "Market participants' reactions to Anadarko's decision to suspend Shenandoah reflect that investors understood before the write-off that Anadarko was unlikely to sanction Shen-6" is not supported by the record and is based on selective use of analyst quotes.

80. On May 3, 2017, Lazard Asset Management noted "The decision to impair Shenandoah (to the tune of ~$1 billion) was surprising given that APC had already drilled 5

[42] Tudor Pickering quote, ¶320(b) of Keller Report.

appraisal wells,"[43] and Drexel Hamilton similarly observed that "We do not think that investors will be happy about the $500mm pre-tax write-off ($0.61 p.s. after tax) after 6 years of exploration and 6 wells were defining the potential size of this project."[44] Moreover, the Sarasin report of April 2017 still ascribed $2.28 billion of value to Shenandoah and Drexel Hamilton valued Shenandoah at $6.25/share just prior to the corrective disclosure.

81. The only support offered for Keller's sweeping conclusion is a series of post-corrective disclosure analyst quotes from May 2 or May 3, 2017. Not one of them indicates that the analyst quoted had previously discussed or predicted a write-off of the Shenandoah assets. I note that my key word searches of "write off," "write-off," "write down," "write-down," and "written off" in all of the analyst reports, transcripts, and other data sources used in the Keller Report did not find any mention of a potential write-off of the entire Shenandoah project prior to the corrective disclosure. Moreover, it would be surprising if, after the fact, some analysts had not attempted to somewhat downplay the write off to: (a) demonstrate to their investor clientele that they were not caught unaware (*i.e.*, doing shoddy research); and (b) to continue to curry favor with Anadarko management.

IX. CONCLUSION

82. For the foregoing reasons, and the summary of opinions listed in Section II of my report, I conclude that the Keller Report does not show that the market already knew the truth about Shenandoah, support a truth-on-the-market defense or undercut allegations in this

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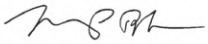
[43] L00000080 at 80 (May 3, 2017 Anadarko Petroleum Corporation report from Lazard Asset Management).

[44] APC-01379611 at 12 (May 3, 2017 Drexel Hamilton analyst report).

case that Anadarko misled investors regarding the commercial viability and producible resource size of Shenandoah during the Class Period.

Executed on January 25, 2023, at New York, New York.



NOAM BERK

APPENDIX A

Noam P. Berk
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SUMMARY

Energy professional with over 25 years of experience as a project finance investment banker, commodity derivatives structurer/originator, and co-founder of a private equity firm specializing in investments in upstream oil and gas development assets.

EXPERIENCE

- Co-founder of IOG Capital, LLC, an investment firm based in Dallas, Texas, which has invested in upstream oil and gas development and drilling projects totaling more than $2 billion since 2015 (2014-present)
- Founder of Dean Street Capital Advisors LLC, a boutique financial consulting firm that advises commodity producers and investors on complex financing and hedging transactions (2008-present)
    - Key transactions include:
        - Exclusive advisor to Chesapeake Energy for their $10 billion multi-counterparty commodity trading facility (2008-2009)
        - Hedge Advisor to Trumbull Clean Energy, a 950 MW gas-fired generating facility in Ohio (2022)
        - Hedge advisor to Niles Energy Center, a 1050 MW gas-fired power generating facility in Michigan (2019)
        - Hedge Advisor to 288 MW gas-fired peaking project Texas (2019)
        - Hedge Advisor to Cricket Valley Energy Center, a 1,000 MW gas-fired generating facility in New York (2016)
        - Hedge Advisor to Lordstown Energy Center, a 940 MW gas-fired generating facility in Ohio (2016)
        - Hedge Advisor to Carroll County Energy Center, a 700 MW gas-fired generating facility in Ohio (2015)
    - Consultant for Chesapeake Energy in legal case involving pricing and hedging associated with oil and gas leases in Texas (2013)

- Expert witness for Seguro Energy in legal case involving development of a biomass power plant in California (2018-present)

- Merrill Lynch – Head of Latin America Commodities (2006-2008)
- Deutsche Bank
  - Director, Structurer/Originator in Commodities Group (2001-2006). Key Transactions include:
    - $500 million Chesapeake Energy reserve-backed commodity trading facility (2004)
    - $300 million Calpine structured power trading facility (2003)
    - $150 million power and gas contract monetization for Northwestern Energy (2003)
    - $250 million private placement that monetized DB trading desk power contracts (2001)
  - Vice President – Project and Structured Finance Group (1997-2001). Key Transactions include:
    - $1.5 billion Offshore Cantarell Nitrogen Injection Facility project financing, Mexico (1997-1998)
    - $2.5 billion Barracuda & Caratinga FPSO project financing, Brazil (1998-2000)
    - $150 million Petrotrin structured bond financing, Trinidad & Tobago (1999)
    - $1 billion Alliance Pipeline project financing, USA/Canada (1999)
    - $1.5 billion Veracel pulp mill project financing, Brazil (2000)
- New York Life
  - Legal Department SQL Database Manager (1993-1995)
  - Associate in Office of the Corporate Secretary (1991-1992)

EDUCATION

Columbia Business School – MBA, Finance (1995-1996)

UNC Chapel Hill – MA, US Military History (1992-1993)

Rutgers University – BA (1991)

Languages: Portuguese (fluent), Hebrew (fluent), and Spanish (conversational)

APPENDIX B

I have relied on all of the documents discussed and cited in my report, including the text and footnotes therein. In addition, I list below documents that I relied on in preparing my report.

I. DOCUMENTS PRODUCED IN THIS LITIGATION

Class Counsel provided me access to the electronic databases (*i.e.*, Relativity Platform) of documents produced in this litigation. Among the documents I relied on are the following:

APC-00000361
APC-00205621
APC-0030785
APC-00578013
APC-01333349
APC-01333456
APC-01379611
APC-01448377
APC-01448787
APC-01752403
APC-01753704
Jan Hen_00014482
L00000080
LAZARD-ANADARKO 0030971
LAZARD-ANADARKO 0045267
SARASIN0000051
SARASIN0002083

II. DEPOSITION TRANSCRIPTS AND EXHIBITS THERETO

September 1, 2022 Deposition Transcript of Darrell Hollek

October 28, 2022 Deposition Transcript of Shandell Marie Szabo

January 17, 2023 Deposition Transcript of Peter Keller

Deposition Exhibit 470 to the October 28, 2022 Deposition Transcript of Shandell Marie Szabo

III. PUBLICATIONS

Cheng Cheng, *et al.*, *Risk measurement of international oil and gas projects based on the Value at Risk method*, 16 Pet. Sci. 199 (2018)

Babak Jafarizadeh, *Discount Rates and Price Forecasts for Upstream Petroleum Valuations*, Heriot-Watt University, Edinburgh, UK (June 2019)

IV. PRESS RELEASES

March 19, 2013 Anadarko press release, "Anadarko Announces Shenandoah Appraisal Well Encounters More Than 1,000 Net Feet of Oil Pay"

May 6, 2013 Anadarko press release, "Anadarko Announces First-Quarter 2013 Results"

V. COURT DOCUMENTS

Amended Complaint for Violations of the Federal Securities Laws, filed August 17, 2020
Corrected Expert Witness Report, by Lyndon Pittinger, dated November 29, 2022
Expert Report of Peter Keller, dated November 9, 2022
Expert Report of Robert Merrill, Ph.D., dated November 9, 2022
Expert Report of Bjorn I. Steinholt, CFA, dated October 1, 2021
Expert Rebuttal Report of Bjorn I. Steinholt, CFA, dated February 2, 2022
Expert Report of Bjorn I. Steinholt, CFA, dated November 9, 2022

VI. SEC FILINGS

Anadarko Petroleum Corporation 2016 Form 10-K, filed February 17, 2017
Anadarko Petroleum Corporation Form 10-Q, filed May 2, 2017